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EDMUND RUFFIN, EDITOR AND PROPRIETOR.

LETTERS OF GEN. GEORGE WASHINGTON TO ARTHUR YOUNG, ESQ., AND SIR JOHN SINCLAIR, &c.

[Concluded from No. 6.]

Philadelphia, October 20, 1792.

SIR:

I have received your letter of the 18th of May, enclosing the pamphlet and papers which you had the goodness to send me. While I beg your acceptance of my acknowledgment, for the polite mark of attention in transmitting these things to me, I flatter myself you will be assured, that I consider the subject therein recommended as highly important to society, whose best interests I hope will be promoted by a proper investigation of them, and the happiness of mankind advanced thereby.

I have to regret, that the duties of my public station do not allow me to pay that attention to agriculture and the objects attached to it (which have ever been my favorite pursuit) that I could wish; but I will put your queries respecting sheep into the hands of such gentlemen as I think most likely to attend to them, and answer them satisfactorily. I must, however, observe, that no important information on the subject can be expected from this country, where we have been so little in he habit of attending either to the breed or improvement of our stock.

With great respect and esteem,
I have the honor to be, sir,
Your most obedient servant,
G. WASHINGTON.

Sir John Sinclair.

Philadelphia, July 20, 1794.

SIR:

I am indebted to you for your several favors of the 15th of June, 15th of August, and 11th of September of the last—and for that of the 6th of February, in the present year; for which, and the pamphlet accompanying them, my thanks are particularly due. To say this, and to have suffered them to remain so long unacknowledged, needs explanation. The truth is, they came to hand—the first of them about the opening, and the second set, towards the close of a long and interesting session of Congress, during which my time was very much occupied, and at the end thereof, I had a pressing call to my estate in Virginia, from whence I have not been returned more than ten or twelve days.

I have read with peculiar pleasure and approbation, the work you patronize, so much to your own honor and the utility of the public. Such a general view of the agriculture in the several counties of Great Britain, is extremely interesting; and cannot fail of being very beneficial to the agricultural concerns of your country and to those of every other wherein they are read, and must entitle you to their warmest thanks for having set such a plan on foot, and for prosecuting it with the zeal and intelligence you do.

I am so much pleased with the plan and execution, myself, as to pray you to have the goodness to direct your bookseller to continue to forward them to me, accompanied with the cost which shall be paid to his order; or remitted so soon as the amount is made known to me. When the whole are received, I will promote, as far as in me lays, the reprinting of them here.

I know of no pursuit in which more real and important services can be rendered to any country, than by improving its agriculture—its breed of useful animals—and other branches of a husbandman's cares;—nor can I conceive any plan more conducive to this end, than the one you have introduced for bringing to view the actual state of them, in all parts of the kingdom; by which good and bad habits are exhibited in a manner too plain to be misconceived; for the accounts given to the British Board of Agriculture, appear in general, to be drawn up in a masterly manner, so as fully to answer the expectations formed in the excellent plan which produced them; affording at the same time a fund of information useful in political economy—serviceable in all countries.

Commons, tithes, tenantry (of which we feel nothing in this country) are in the list of impediments I perceive, to perfection in English farming; and taxes are heavy deductions from the profit thereof. Of these we have none, or so light as hardly to be felt. Your system of agriculture, it must be confessed, is in a style superior, and of course much more expensive than ours; but when the balance at the end of the year is struck, by deducting the taxes, poor-rates, and incidental charges of every kind, from the produce of the land, in the two countries, no doubt can remain in which scale it is to be found.

It will be some time, I fear, before an agricultural society with congressional aids will be established in this country; we must walk, as other countries have done, before we can run. Smaller societies must prepare the way for greater: but with the lights before us, I hope we shall not be so slow in maturation as older nations have been. An attempt, as you will perceive by the enclosed outlines of a plan, is making to establish a state society in Pennsylvania, for agricultural improvements. If it succeeds, it will be a step in the ladder; at present it is too much in embryo to decide on the result.

Our domestic animals, as well as our agriculture, are inferior to yours in point of size; but this does not proceed from any defect in the stamina of them, but to deficient care in providing for their support; experience having abundantly evinced, that, where our pastures are as well improved as the soil and climate will admit—where a competent store of wholesome provender is laid up, and proper care used in serving it,—that our horses, black cattle, sheep, &c. are not inferior to the best of their respective kinds which have been imported from England. Nor is the wool of our sheep inferior to that of the *common* sort with you:—as a proof, after the peace of Paris in 1783, and my return to the occupation of a farmer, I paid particular attention to my breed of sheep (of which I usually kept about seven or eight hundred). By this attention, at

the shearing of 1789, the fleeces yielded me the average quantity of 5¼lbs. of wool; a fleece of which, promiscuously taken, I sent to Mr. Arthur Young, who put it, for examination, into the hands of manufacturers. These pronounced it to be equal in quality to the Kentish wool. In this same year, *i. e.* 1789, I was again called from home, and have not had it in my power since to pay any attention to my farm; the consequence of which is, that my sheep, at the last shearing, yielded me not more than 2½lbs. This is not a single instance of the difference between care and neglect. Nor is the difference between good and bad management confined to that species of stock; for we find that good pastures and proper attention, can, and does, fill our markets with beef of seven, eight and more hundred weight, the four quarters; whereas from 450 to 500 (especially in the states south of this, where less attention hitherto has been paid to grass,) may be found about the average weight. In this market, some bullocks were killed in the months of March and April last, the weights of which, as taken from the accounts which were published at the time, you will find in a paper enclosed. These were pampered steers, but from 800 to 1000 lbs. the four quarters, is no uncommon weight.

Your general history of sheep, with observations thereon, and the proper mode of managing them, will be an interesting work when completed; and with the information, and accuracy, I am persuaded it will be executed under your auspices, must be extremely desirable. The climate of this country, particularly that of the middle states, is congenial to this species of animal; but want of attention to them in most farmers, added to the obstacles which prevent the importation of a better kind, by men who would be at the expense, contributes not a little to the present inferiority we experience.

Mr. Edwards would have it as much in his power as most of our farmers, to solve the queries you propounded to him: in addition to which, a gentleman of my acquaintance (who is also among the best farmers of this country,) to whom I gave the perusal of your propositions, has favored me with some ideas on the subject, as you will find on a paper, herewith enclosed.

The sample you were so obliging as to put into the hands of Mr. Lear, for me, of a Scotch fabric, is extremely elegant, and I pray you to accept my thanks for it, as I entreat you also to do for the civilities shown to that gentleman, who has a grateful sense of them.

Both Mr. Adams, and Mr. Jefferson, had the perusal of the papers which accompanied your note of the 11th of September.

With great respect and esteem,
I have the honor to be, sir,
Your obedient servant,
G. WASHINGTON.

Philadelphia, 10*th July*, 1795.

SIR:

I could not omit so favorable an opportunity, as the departure of Mr. Strickland affords me, of presenting my best respects to you; and my sincere thanks for the views of agriculture in the different counties of Great Britain, which you have had the goodness to send me; and for the diploma, (received by the hands of Mr. Jay) admitting me a foreign honorary member of the Board of Agriculture.

For this testimony of the attention of that body, and for the honor it has conferred on me, I have a high sense; in communicating of which to the Board, I shall rely more upon your goodness than on any expression of mine to render it acceptable.

From the first intimation you were pleased to give me of this institution, I conceived the most favorable ideas of its utility; and the more I have seen, and reflected on the plan since, the more convinced I am of its importance, in a national point of view, not only to your own country, but to all others which are not too much attached to old and bad habits to forsake them, and to new countries that are *just beginning* to form systems for the improvements of their husbandry.

Mr. Strickland has not been idle since he came to this country. To him, therefore, for a description of the climate—the soil—the agriculture, and the improvements generally; the modes of carrying them on—the produce of the land—the draught cattle—domestic animals—and the farming implements which are used by our people in the eastern and middle states, through which he has passed, I shall refer you. Nothing I believe, has escaped his observation that merited notice.

You will add to the obligations already conferred on me, by directing your bookseller to supply me regularly with all such proceedings of the Board, as are intended for the public; and when they are in a fit state for it, that they may be neatly bound. To this request, I pray he may be desired to add the cost, which shall be paid at sight, to his order here, or remitted to him as may be most convenient and agreeable to himself.

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[*Note.*—The remainder of this letter, was merely a conclusion in the usual terms, and is wanting, having been cut off and given to a gentleman, who requested it, as a particular favor, "there being nothing, he declared, he wished for more, than to have in his possession a specimen of the handwriting and above all, the signature of the illustrious Washington." JOHN SINCLAIR.]

London, 10*th Feb.* 1800.

Philadelphia, 20*th February*, 1796.

SIR:

When I last had the honor of writing to you, I had hopes, though I must confess they were not of the most sanguine sort, that I should have been enabled ere this, to have given you a more satisfactory account of the business you had been pleased to commit to me than will be conveyed in this letter.

Doubts having arisen, from peculiar calls on the treasury of this country for money, (occasioned by the expenses of our wars with the Indians, the redemption of our captives at Algiers, obtaining peace with that regency and Morocco, together with other demands, in addition to the ordinary expenditures of government), that funds with difficulty would be provided to answer them, without imposing additional taxes; a measure wished to be avoided. I was constrained (after consulting one or two influential members of the legislature), from introducing your plan for a contribution: and, under these circumstances, I avoided communicating the "Extracts from the Minutes of the Proceedings of the Board of Agriculture,

respecting Mr. Elkington's mode of draining," &c. except to one gentleman only, in whom I had entire confidence, and who I knew was always disposed to promote measures of utility. These being the grounds of my proceeding, I shall hope, although your expectations may be disappointed, you will receive the information as an evidence of my candor.

Agreeably to your desire, I have put the "outlines of the 15th chapter of the proposed General Report from the Board of Agriculture, on the subject of manures," into the hands of one of the most judicious farmers within my reach, and when his observations thereon are received, they shall be transmitted to you. I wish my own engagements would allow me time to attend, more than I do, to these agreeble and useful pursuits; but having been absent from what I consider my proper home (except on short occasional visists) for more than seven years; and having entered into my 65th year, a period which requires tranquillity and ease, I have come to a determination to lease the farms of my Mount Vernon estate, except the mansion-house farm, and a grazing one, three miles off, which I shall retain in my own occupation for amusement, whilst life and health is dispensed to me. And as many farmers from your country have emigrated to this, and many more, according to their accounts, are desirous of following, if they know beforehand where and on what terms they could fix themselves compactly in a healthy and populous country, I have taken the liberty to enclose you the copy of a notification which I have published in some of the gazettes of the United States; that in case any farmer answering the descriptions therein contained are about to transplant themselves, to whom you might be inclined to give the information, that you may have it in your power to do so. But let me entreat you, sir, to believe, that I have no wish to its promulgation farther than I have declared; that I have no intention to *invite* emigrants, even if there are no restrictive acts against it—and even if there be, that I am opposed to it altogether.

As wheat is the staple produce of that part of the country in which this estate lies, I shall fix the rent therein, at a bushel and a half for every acre of arable land contained within the lease; to be discharged, in case of failure of that crop, at the price the article bears in the market.

I have but little expectation that arrangements will be made by the time limited, for giving possession of the farms next year; nor should I wish to do it with such unskilful farmers as ours, if there was a prospect of obtaining them from any other country, where husbandry was better understood, and more advantageously practised. It is time, however, to conclude; for I feel ashamed at having employed so much of it, in matters interesting to myself only; and I shall do it with assurances as sincere as they are warm, of being, sir,

Your most obedient and obliged servant,

G. WASHINGTON.

Sir John Sinclair, Bart.

Philadelphia, 12th June, 1796.

SIR:

A long and interesting session of congress, which did not close until the first day of this month, and the laws, which required to be carried into execution promptly, will, I am persuaded, be admitted as a reasonable excuse for my not writing to you since the 20th of February last, agreeably to assurances then given. But what apology can I offer, *now* that I am about to give you the result of the inquiries you requested me to make, when it will be found to fall so far short of what you might have expected from the time which has been taken to render it.

Your wishes on this head, I communicated to Richard Peters, esq. who is one of the most intelligent and best practical as well as theoretical farmers we have; with a desire that he would advise with others, and condense their observations in a summary statement.

Why this was not done, and why he could do no more, you will find in his own original letter, with the questions and answers therein enclosed.

To Mr. Peters's experience with respect to gypsum as a manure, let me add the following as an unequivocal evidence; that it has no effect on stiff heavy land that does not absorb or permit the water on the surface occasioned by superabundant falls of rain or snow to penetrate quickly; which is the case generally with the soil of my estate at Mount Vernon. The experiment and proof to which I alluded, were made eight or nine years ago; at the rate of from one to twenty bushels of the plaster paris to the acre, (among other things to ascertain the just quantum to be used). I spread it on grass grounds and on ploughed land; on the latter, part of it was ploughed in; part harrowed, part scratched in with a light bush, while another part lay undisturbed on the surface; all with oats in the spring. But it had no more effect in *any* instance *then*, or *since*, than so much of the earth it was spread over would have had, if it had been taken up and spread again.

I have the honor to be. sir, &c.

G. WASHINGTON.

Sir John Sinclair.

Philadelphia, March 6th, 1797.

SIR:

On the 11th of December, I wrote you a long letter; and intended before the close of the last session of congress, (which ended on the third instant, conformably to the constitution,) to have addressed you again; but oppressed as I was with the various occurrences incident thereto, especially in the latter part of it, it has not been in my power to do so during its continuance; and now, the arrangements necessary to my departure from this city, for a more tranquil theatre, and for the indulgence of rural pursuits, will oblige me to suspend my purpose until I am fixed at Mount Vernon, where I expect soon to be; having resigned the chair of government to Mr. John Adams, on Friday last; the day on which I completed my second four years' administration.

Under the circumstances here mentioned, I should not have troubled you, at this time, with so short a letter, but for the purpose of accompanying it with two or three pamphlets on the subject of agriculture; one of which treats more extensively on gypsum as a manure, than any I have seen before. The other two will only serve to show, that essays of a similar kind are making in this infant country.

I am sorry to add that nothing *final* in congress, has been decided respecting the institution of a national Board of Agriculture, recommended

by me, at the opening of the session. But this did not, I believe, proceed from any disinclination to the measure, but from their limited sitting, and a pressure of, what they conceived, more important business. I think it highly probable that *next* session will bring this matter to maturity.

I have the honor to be, sir, &c.

G. WASHINGTON.

Sir John Sinclair.

Mount Vernon, July 15th, 1797.

SIR:

Since my last to you, dated in Philadelphia the 6th of March, I have been honored with your's and Lord Hawke's joint favor of the 28th of March, 1796, introductory of Doctor Scandalla; who gave me the pleasure of his company in June last, and whom I found a very sensible and well informed man.

I have also received your separate favors of the 21st of February, and 29th of March, in the present year. The last accompanying your printed account of the origin of the Board of Agriculture and its progress for the three years after its establishment. For your kindness in forwarding of them, I pray you to accept my best thanks.

I will keep one copy of this work myself, and shall read it, I am sure with pleasure, so soon as I have passed through my harvest, which is now nearly finished; the other copies shall be put into such hands, as I conceive will turn them to the best account.

Your not having, in either of the letters acknowledged above, mentioned the receipt of two from me, dated the 10th and 11th of December, 1796; the last a private and very long one, fills my mind with apprehension of a miscarriage, although I do not see how it should have happened, as they went with several other letters under cover to Mr. King, (our Minister in London,) who in a letter to me, dated the 6th of February following, after giving information of what he had done with my other letters, adds "and as soon as Sir John Sinclair returns to town, I will also deliver the letter addressed to him." Was it not for this information I should by this conveyance, have forwarded a duplicate.

The result of my inquiries of members of congress, attending the December session, varied so little from the details I had the honor to give you concerning the prices of land, &c. in my private letter of the 11th of December, as to render a second edition unnecessary. The reduction however, in the price of our produce since last year, (flour having fallen from fifteen to seven or eight dollars a barrel, and other articles in that proportion,) may occasion a fall in the price of lands: a stagnation it has already produced; and, I have been told, a reduction also, in some of the latter sales.

Our crop of wheat this year, from the best information I have been able to obtain, will be found very short, owing to three causes; an uncommon drought last autumn, a severe winter with but little snow to protect it, and which is still more to be regretted, to what with us is denominated the Hessian fly, which has spread devastation, more or less, in all quarters; nor has the latter wheat escaped the rust. The grain however, except where the rust appeared before it was hard, is extremely fine. We are equally unlucky in our oats, occasioned by a severe drought since the month of April. With sentiments of high esteem and regard,

I have the honor to be, sir, &c.

G. WASHINGTON.

Sir John Sinclair.

Mount Vernon, 6th November, 1797.

SIR:

Since I had the honor of writing you on the 15th July, I have been favored with your letter of the 13th of February, introductory of Thomas Macdonald, esq. and your note of the 9th of June, by General Kosciusko; together with the surveys, and papers accompanying both. For your goodness in sending them, I pray you to accept my best thanks, and that I may not be a burthensome member of the board, I enclose a small bill of exchange, to be deposited in the hands of your bookseller, to defray the cost of the several copies of your works which may be forwarded to me. When this is expended, I will make another deposite for the same purpose.

As neither of these notes, the receipts of which is acknowledged above, nor any other has intimated in the most distant manner, that my letters of the 10th and 11th of December, (the latter a private one) had ever reached your hands, I now do, as well for the purpose of evincing that I was not inattentive to your request, as to give information which may yet (though late) be useful, forward a duplicate of the private letter, from a press copy taken at the time, and of my last also, of the 15th of July; being more disposed to trouble you with a repetition of the sentiments then expressed, than to lay under the suspicion of inattention to your commands.

I can now, with more certainty than on the 15th of July, inform you that lands have fallen in price; ascribable to two causes, the shocking depredations committed on our commerce (within the last six or eight months by the French,) and the reduction in price of our produce.

Our crops of grain are, in places, tolerable, but upon the whole below mediocrity.

An eight years' absence from home (except occasional short visits to it,) has thrown all my building and other matters of private concern, into so much disorder, that at no period of my life have I ever been more engaged, than in the last six or eight months, to repair and bring them into tune again: this has prevented me from looking into the agricultural surveys of the counties of England and Scotland, with the attention I propose to do the ensuing winter. I shall certainly be very desirous of having a complete set of them, and if any are missing will apply accordingly, as it is my intention to have them classed, and bound neatly. With great pleasure, I received a visit from Mr. Macdonald a few days ago, who fully answers the character given of him, as a polite and sensible man.

I have the honor to be, sir, &c.

G. WASHINGTON.

Sir John Sinclair, Bart.

Since this work was sent to the press, I find that one of General Washington's most interesting letters has been lost. There is fortunately, however, an extract from it, in the first volume

of the communications published by the Board of Agriculture (p. 374,) a copy of which I beg leave to lay before the reader, from that publication.

Philadelphia, 10th December, 1796.

"The results of the experiments entrusted to the care of Dr. Fordyce, must be as curious as they may prove interesting to the science of husbandry. Not less so, will be an intelligent solution of those queries relative to live stock, which are handed to the public.

"A few months more, say the 3d of March next (1797,) and the scenes of my political life will close, and leave me in the shades of retirement; when if a few years are allowed me to enjoy it (many I cannot expect, being upon the verge of sixty-five,) and health is continued to me, I shall peruse with pleasure and edification, the fruits of the exertions of the Board for the improvement of agriculture; and shall have leisure, I trust, to realize, some of the useful discoveries which have been made in the science of husbandry.

"Until the above period shall have arrived, and particularly during the present session of congress, which commenced the 5th instant, I can give but little attention to matters out of the line of my immediate avocations. I did, not, however, omit the occasion, at the opening of the session, to call the attention of that body to the importance of agriculture. What will be the result, I know not at present; but if it should be favorable, the hints which you will have it in your power to give, cannot fail of being gratefully received by the members who may constitute the board."

CONCLUSION.

On the Character of General Washington.

Whoever has perused the preceding letters, will, I trust, concur with me* in the following reflections.

1. That nothing could possibly place the character of this distinguished statesman in a more estimable light, than that of beholding the same individual, whose military exploits had spread his fame over the universe, and who had been invested with supreme power in the country where he was born; in the midst of all his various public avocations, carrying on an extensive correspondence, with the native of distant country, on agricultural and other general inquiries of a similar nature.

2. That those who are blessed with a reflecting and philosophical mind, must contemplate with pleasure and delight, a person elevated, by the voice of his fellow-citizens, to the summit of political authority; who, instead of wishing to aggrandize himself, and to extend his power, was anxiously bent to quit that situation, to which so many others would have fondly aspired, and to return to the comfort and enjoyment of private life: belying thus the insinuations of those malignant spirits, who are perpetually railing against the talents and virtues which, conscious of wanting themselves, they do not believe that others can possess.

3. Is there, on the whole, any individual, either in ancient or modern history, who has prouder claims to distinction and pre-eminence, than the great character whose letters this volume contains? His military talents were early celebrated; first in the service of Great Britain, and afterwards in that of America. His powers as a statesman, and as the founder of a constitution, which, with British prejudices, I may consider as inferior to our own, but which promises to secure the happiness of the great nation it was formed to govern, cannot possibly be questioned. His public virtue, as the uncorrupted magistrate of a free people, who reluctantly received supreme authority, when it was judged necessary for the public good for him to assume it, and who anxiously wished to resign it into their hands when it could be done with public safety, can hardly be equalled in history. His literary endowments were unquestionably of a superior order: his letters in this collection, his addresses to the American Congress, and his farewell oration, when he quitted, for the last time, the presidency of the United States, are models of each species of composition. His closing a well-spent life, after a short illness, without having his strength or faculties impaired by any previous disorder, or any untoward circumstance having occurred, that could materially affect his feelings, or could possibly tarnish his fame, is an uncommon instance of good fortune. The scene in which he acted also, and the object which he achieved, are the most memorable which history furnishes. For it was such a man alone, who by combining the force, and commanding the confidence, of thirteen separate states, could have dissolved those ties which subjected America to Europe, and to whom the political separation of two worlds is to be attributed. But, above all, what distinguished this celebrated warrior and statesman is, that to all those military and public talents, and to those literary endowments, which are so rarely united in the same person, he added the practice of every virtue that could adorn the private individual. It were in vain for me to attempt adequately to express the ideas I entertain of a character, in every respect so peculiarly splendid. The pen of the immortal Shakspeare, is alone competent to the task, and on the tombstone of the illustrious Washington let it be engraved,—

> "His life was gentle, and the elements
> So mixed in him, that Nature might stand up
> And say to all the world—This was a man,
> ——————take him for all in all,
> We shall not look upon his like again."*

From the British Farmer's Magazine.

ON RAISING MIXED CROPS, WITH A VIEW OF SECURING OR INCREASING PROFITS.

Although, in general, the different species and varieties of field crops are sown or planted by themselves, they are, in a few cases, intermixed; that is, two sorts are sown, reaped, and thrashed together. This practice depends on a few circumstances which are favorable thereto, such as suitability to the same soil; sowable at the same season, and in the same manner; ripening together; separable, if necessary, in the barn; or, if not, that may be used or sold together.

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* Sir John Sinclair.

*Julius Cesar, Act V. Scene 5—and Hamlet, Act I. Scene 2.

The idea, that mixed seeds always succeed better than any one by itself, is founded upon the supposition, that every different species of plant imbibes food peculiar to itself, and as there must be less rivalry among a heterogeneous than in a homogeneous assemblage, each sort will secure for itself a more abundant share of its natural food. That this notion is not merely suppositional, but a reality, is often proved by the fact, that a mixture of red and white wheat always yields a heavier crop both of grain and straw than if kept and sown separate in the same field; and, moreover, if sown separately, the plants, at the line of junction, where the sorts are in some degree accidentally mixed, are the strongest in the field.

It was formerly a custom to sow spring wheat and barley together, in order to be ground into meal for baking into bread; but this practice has been long abandoned.

Peas are always considered a precarious crop, especially in dry summers; and, lest any loss should be sustained by peas alone, oats are frequently mixed and sown with them. These grow well together; the oats supporting the peas, and the peas shading the ground, and thereby nursing the oats. Three quarters of peas and four quarters of oats are frequently obtained by growing them together; and a vast quantity of excellent fodder either for the cribs or racks in winter, or for cutting into chaff. The grain is easily separated in the barn, by simple *throwing* from one end of the thrashing-floor to the other. The large black Poland, or Tartarian sorts of oats, and either the maple or common hog-peas, are best for growing together.

Instead of oats, common horse beans are sometimes sown to great advantage; the beans serving to prop the peas, and, consequently, rendering them more prolific. This mixture answers best on strong loamy soils, it never being attempted on thin or light land. This mixed grain is chiefly used for pig feeding; and, in the market, is called *polts* or poults.

In some rich, loamy districts of the kingdom, where the *early nimble* pea can be cultivated, a cast of turnip seed is thrown over before the last hoeing, and when the peas are off, the stubble is first harrowed, and the turnip plants, if enough have risen, are regularly thinned by the hoe. The same thing is done among beans. The turnip seed is sown in June or July, before the last hoeing; or, if there be no weeds, the surface is chopped over, to bury the seed. By this extra labor, a fair sprinkling of turnips for spring feed will remain after the beans are off. This, however, is only done when wheat does not succeed beans, and where the soil is moist and very mellow.

Where buck-wheat is cultivated, and which is not intended to be followed by wheat, turnips may be sown at the same time, and which sometimes answers very well in raising—not large bulbs indeed, but a fair bite of herbage to help out the main crops of turnips in the spring.

Sowing grass-seed with barley or oats, or harrowing and rolling it in upon wheat in the spring, are every-day practices, and have long been established by custom as the best methods of culture, from the economy of putting in two years' crops, by the same labors, in one. Some agriculturists prefer laying down permanent pasture seeds without corn, and sowing them, not in the spring, but in the month of August. Their reasons for this, are, first, that the ground intended for permanent grass should receive a thorough cleansing from weeds, and which cannot be effectually done without a summer fallow; secondly, the heat of the sun so destructive to young grass, as well as the turnip fly at the same time, are less to be feared in the autumn than in the earlier months of the year; and, therefore autumn-sown seeds seldom fail.

J. G.

From the Farmer's Magazine.

ON MANURE FOR WHEAT.

We can strongly recommend the following paper, on the choice of manure, to the notice of our readers. It is from an able work on the varieties, properties, and classification of wheat, by Colonel Le Couteur:—

"The effect of different manures on wheat is very remarkable; it will not be necessary to say much on the subject, as it is almost exhausted, having been fully treated by far more able pens; but having made some experiments on the subject, I may be excused from publishing their results.

"I confine my observation to those manures which are within the reach of most farmers, with one or two exceptions.

"Stable manure will, in ordinary good soils have the effect of causing the plants to tiller much, or to make straw and grass, thereby diminishing the produce in grain and meal considerably.

"Liquid manure, one third stable drainings, and two-thirds water, which I caused to be poured once over wheat that was just tillering, made the straw grow rank and coarse, the grain of every variety of wheat was dark and thick-skinned, hence containing less meal. The same quantity and mixture of liquid manure poured a second time over another portion of wheat, caused it to grow so rank and full of leaves, rather than straw, that only a few of the plants produced ears of wheat, some having run up into sharp points, with merely the rudiments of ears indicated. The few ears that produced corn, displayed in its worst form, hardly in the shape of meal, of a doughy soft texture, evidently unfit for the food of man; besides, some of them were smutty. Thus, an over application of manure, excellent when judiciously applied, becomes a poison, precisely in the same manner as in the human constitution, a surfeit is usually the parent of some disease.

"The wheat on either side of these experiments, which had only been manured with the ashes of kelp, or sea-weed, was healthy, productive, and farinaceous in the highest degree.

"My attention was particularly called to the proper application of manures by an old and experienced farmer, who considered kelp or the ashes of rock sea weed, that which is cut, the best of all. I am convinced by subsequent experience, that two or three pounds worth of it per acre, spread at the proper period, about two months before sowing time, would always more than repay itself.

"It attracts moisture from the atmosphere, it materially increases the volume of the grain, and fineness of the sample; but does not add to the weight of the straw, though rendering it whiter and more nourishing to cattle. It causes the wheat

to assume a rich healthy appearance, and is an excellent application after a crop of potatoes or parsnips, both of which require land to be richly dressed with stable or other strong manures, and has not the effect of decomposing them, as lime does.

"It is also destructive to insects and their eggs, which lie in the soil or turf; it forces the earth-worms and wire-worms from their lurking places to come to the surface and die; particularly when laid on in a larger quantity than I have named, some farmers being in the habit of putting on double, even treble the quantity above stated—but I believe without having produced proportionably larger crops from inferior land; though it has been asserted that its effect is very permanent, being especially apparent on the succeeding clover crops.

"I am inclined to believe that paring and burning an old ley will almost produce an equally good effect where the land is suited for it; for although the ashes may not be of that superior quality, or possessing all those virtues peculiar to kelp ashes, and the much greater portion of ashes that can by this means be spread on the land may make amends in quantity for quality.

"An additional circumstance in favor of paring and burning is, that all the seeds or weeds, or the eggs and insects which lie concealed in the turf, are thereby destroyed more effectually than by any repeated ploughings.

"The careful experience of five years on this head has convinced me of the propriety of this practice occasionally, especially on ground infested with couch or knot-grass. From three acres of land that had been pared and burned, which produced five hundred and forty single horse loads of ashes, I obtained a very heavy crop of turnips; the following year I raised ninety-one thousand pounds of potatoes, and by an application of about forty-five bushels of lime per acre, I have since reaped fifty-one imperial bushels of wheat per acre; the straw also was of very fine growth, five feet high, and exceedingly white and bright.

"Kelp ashes should lay on the surface of the soil a month or two previous to sowing time, in order to weaken their caustic power, or they are otherwise apt to burn the young and tender shoots of the corn, as well as the larvæ of insects; but by laying a certain length of time on the surface exposed to the action of the atmosphere, or perhaps, what would be better practice, merely lightly turned into the soil, they become eminently beneficial.

"I am so partial to the use of ashes, that I should recommend those who have large woods or forests to employ women and children to collect the dry and broken boughs and under shrubs to be burned for the sake of the ashes, which would be found nearly equal to those of the sea-weed, and could thus be procured at a much cheaper rate; besides gaining the advantage of converting what is now wasted, or neglected, into a most valuable and permanent manure, perfectly free from weeds, and destructive to insects and worms.

"Ashes are further beneficial, inasmuch as they attract the moisture from fogs and dews, and retain it a considerable length of time.

"Lime is so well understood as a manure for wheat, that it would be a mere waste of time to say more on the subject than as far as my own experience goes, it appears to impart a greater degree of whiteness to the straw than any other manure. Its other excellent qualities of absorbing moisture from the atmosphere in dry weather, on light or gravelly soils, and increasing the weight of the grain, are well understood; it is to be lamented that some general rule for its application is not made known, as, in the best books I have consulted on the subject, it varies in the extraordinary proportion from fifty-six to five hundred bushels per acre, which last appears to me to be an absurd quantity.

"I have found it to answer perfectly at the rate of forty or fifty bushels an acre on a good loam, and I should apprehend that double that quantity ought to be sufficient for the poorest land, unless it be to destroy moss, when a still larger top dressing is required, which, if well harrowed in, does it effectually. This commixture of turf and lime, if soon after ploughed in, in turn, becomes itself a manure for the very soil the turf previously rendered barren.

"Soot is said to be an excellent top-dressing. I have tried it but once, without having perceived the advantageous results that are said to be derivable from it; it is only in the environs of towns or villages that it can be obtained in sufficient quantity to be available to a large farmer."

AN EXTRAORDINARY MODE OF HATCHING CHICKENS.

No one, whilst at Ghizeh, should omit seeing the chicken *manufactory*, where two old men perform the maternal duties of as many thousands of the gallinaceous tribe. The eggs are spread out on a flat surface of clay, in ovens, kept of course, night and day, at a uniform degree of heat. The old men visit their charge constantly, turning the eggs with long poles, so as to bring every part of their surfaces in occasional contact with the clay bottom of the oven, which is somewhat warmer than the atmosphere. It is an extraordinary sight! Every instant some little animal, in his struggles to enter this world of troubles, bursts its shell, and starts into life, (an orphan from his birth!) keeping the surface in a constant state of *agitation*.—They are immediately taken out of the oven, placed in baskets, and sold by *measure*—every old woman in the neighborhood buying a pottle of the miserable little creatures to take home and dry nurse, until they are of an age to shift for themselves. I believe this method of hatching chickens is common throughout Egypt, although I cannot state on my own authority, that such is the case; if so, it may account for the degeneracy of the breed of fowls, for they are invariably small, though the eggs are not much less than those usually met with in other countries.—*Scott's Rambles in Egypt and Candia.*

From the Farmer's Magazine.

TAPE WORM IN THE POINTER AND SPANIEL.

On an estate where a great quantity of rabbits are annually destroyed in the month of November, I have observed that several dogs who were previously in good health and condition, soon became weak, listless, and excessively emaciated, frequently passing large portions of the tape-worm: this induced me to examine the intestines of

several hares and rabbits, and, with very few exceptions, I found each to contain a perfect tapeworm, from three to four feet in length. I then caused two of the dogs, whose cases appeared the worst, to be separated from the others, feeding them on potatoes, &c.; and in eight or ten days, after voiding several feet of the worm, they were perfectly restored to their former strength and appearance. The vermicular disease, hitherto so formidable to the spaniel and pointer, may therefore in a great measure to be fairly attributed to the custom of giving them the intestines of their game, under the technical application of "the paunch." The facts above stated, in explaining the cause of the disease, at the same time suggests the remedy.

From the Farmer's Magazine.

THE FERRET.

This animal, which is a sort of domestic in Europe, was said to be originally brought from Africa into Spain, which being a country abounding in rabbits, required an animal of this kind more than any other; however this be, it is not to be found, except in a domestic state, and it is chiefly kept tame for the purposes of the warren.

The ferret is about one foot long, being four inches longer than the weasel. It resembles that animal in the slenderness of its body, and the shortness of its legs; but its nose is sharper, and its body more slender in proportion to its length. The ferret is commonly of a cream color, but there are others of a dark chocolate, which ignorant people assert are the offspring of the polecat and the ferret.

As this animal is a native of the torrid zone, so it cannot bear the rigors of our climate without care and shelter, and it generally repays the trouble of its keeping by its great utility in the warren. It is naturally such an enemy of the rabbit kind, that if a dead rabbit be presented to a young ferret, although it has never seen one before, it instantly attacks and bites it with an appearance of rapacity. If the rabbit be living, the ferret is still more eager, seizes it by the neck, winds itself round it, and continues to suck its blood till it be satiated.

The female of the species is usually less than the male, whom she seeks with great ardor. They are usually kept in boxes or pens, and plentifully supplied with straw or other materials of which to make themselves a warm bed, which serves to defend them from the rigor of the climate. They sleep almost continually, and the instant they are awake they seem eager for food. They are usually fed with bread and milk. They breed twice a year, and some of them devour their young as soon as brought forth. Their number is usually from five to six in a litter.

Upon the whole, this is an useful, but a disagreeable and offensive animal; its scent is fetid, its nature voracious; it is tame, without any attachment, and such is its appetite for blood that it has been known to attack and kill children in the cradle. It is easily irritated, and although at all times its smell is very offensive, it then is much more so, and its bite is very difficult of cure.

The ferret is principally bred by warreners and rat catchers, and in the pursuit of rats and rabbits it will encounter any difficulty or danger when once put upon the scent. It has a natural and instinctive propensity for burrowing, and wherever the head can enter the body will follow. Whenever the ferrit has secured the prey he is in pursuit of, he extracts the blood with uncommon eagerness by suction, but seems indifferent to the flesh. When used in warrens, their mouths are sewed up, that they may alarm the rabbits, and drive them from the burrows to the nets, without being able to seize them; as, if they were enabled to seize them under ground, they would with difficulty be got from the burrows. When they are used for the purpose of rat catching, they are put into the holes, and if there are any rats in the neighborhood, they will soon be seen scampering away from their most dreaded enemy. Terriers are stationed at the mouth of the holes to receive the rats, and the latter will sooner encounter every danger, and face dogs or men, or both, than wait for the ferret. If the ferret happens to seize one in the hole, it immediately sucks the blood, goes to sleep, and the owner will have many hours to wait before he is able again to obtain his ferret.

Experienced warreners, however, seldom make use of a ferret, but prefer taking the rabbits with hay nets; as where the ferret is used, it gives the rabbits a dislike to the burrows, for a long time afterwards.

VALUE OF THE WILLOW.

The importance of the willow to man has been recognized from the earliest ages; and ropes and baskets made from willow twigs were probably among the very first of human manufactures, in countries where these trees abound. The Romans used their twigs for binding their vines and tying their reeds in bundles, and made all sorts of baskets of them. A crop of willows was considered so valuable in the time of Cato, that he ranks the salictum, or willow field, next in value to the vineyard and the garden. In France, the leaves, whether in a green or dried state, are considered the very best food for cows and goats; and horses, in some places, are fed entirely on them, from the end of August till November. Horses so fed, it is stated, will travel 20 leagues a day without being fatigued. In the north of Sweden, and Norway, and in Lapland, the inner bark is kiln-dried and ground, for the purpose of mixing with oatmeal in years of scarcity. The bark of the willow, and also the leaves, are astringent; and the bark of most sorts may be employed in tanning.—*Arboretum Britannicum.*

ON THE NATURAL SUCCESSION OF FOREST TREES IN NORTH AMERICA.

By J. M., Philadelphia.

In Vol. III. p. 351, an extract is given from Evelyn's letter to Sir John Aubrey, stating that beech trees grew in place of oaks which had been cut down by his grandfather, and that birch succeeded beech which his brother had extirpated. In the United States, the spontaneous succession of timber, of a different kind from that cut down, is well known. In the *Memoirs of the Philadelphia Society for promoting Agriculture*, Vol. I., there are several papers on this subject, by the president, the late Richard Peters; by Dr. Mease; by Mr. John Adlum, who had long been a surveyor in the new settlements in Pennsylvania; by Dr.

Caldwell, in reference to the fact in North Carolina, in Massachusetts, and in New Jersey; and a confirmation of it in the last mentioned state, by Mr. Thomas F. Leaming. In the third volume, Mr. Isaac Wayne, son of the American general, the late A. Wayne, also gives some interesting details respecting the appearance of timber trees, of a kind different from those which formerly covered the ground in his vicinity, and which had been cut down by the American army, when encamped there in the autumn and winter of the year 1777, and spring of the following year. One of the above writers refers to the relation of Mr. Hearne, (*Journey to the Northern Ocean*, p. 452,) for the fact of strawberries growing up wild near Churchill river, and in the interior parts of the country, particularly in such places as have been formerly set on fire; and for that of hips and raspberry bushes shooting up in great numbers, in burnt places, where nothing of the kind had ever been seen before. Cartwright is also quoted, in proof of the point. He observes, "that if through carelessness the old spruce woods are burnt, or by lightning, Indian tea first comes up. currants follow, and after them birch." (*Jour. of Trans. at Labrador*, Vol. I. p. 225.) Nine years after the publication of this last work, M'Kenzie stated, that "land covered with spruce-pine, and white birch, when laid waste by fire, produced nothing but poplars;"* and yet the Edinburgh reviewer of his work very indelicately declared his disbelief of the relation. Recently, we have additional testimony on this subject. In the 'Manual on the Culture of Silk,' prepared in consequence of a resolution of the House of Representatives of the American Congress, and published in the session of 1828, it is stated (p. 38) that "in Tennessee, when a native forest is cut down, if the land be enclosed, a growth of red mulberry trees soon takes place." All these statements do not admit a doubt to be entertained of the natural succession of forest timber; the fact is moreover familiar to every man who has lived in the country, and to almost every intelligent person in North America. I regret that the enterprising voyager did not live to shame the northern critic for his rudeness, and to enjoy the satisfaction of seeing his own testimony of a curious and interesting fact in natural history confirmed by others. —*Gardener's Magazine.*

From the Horticultural Register.

THE FIG, AND THE PROCESS OF CAPRIFICATION.

The fig tree is a low shrub naturalized in Italy and the south of France, and enduring the open air in the mildest parts of Britain and the United States. This tree in France and Italy, grows as large as our apple trees, but in England and this country† seldom exceeds two yards in height; the trunk is about the thickness of a human arm; the wood is porous and spongy; the bark ash colored; the branches smooth with oblong white dots; the leaves annual in the temperate zones, but perennial within the topics, cordate, ovate, three or five-lobed, thick and the size of the hand. The fruit is a berry, turbinate, and hollow within; produced chiefly on the upper part of the shoots of the former year, in the axils of the leaves, on small, round peduncles. The flowers are produced within the fruit, what is considered as the fruit being a common calyx receptacle; the male flowers are few, and inserted near the opening, in the extremity of the receptacle, or fruit; the female flowers are very numerous, and fill the rest of the hollow space within. The greater part prove abortive, both with and without the process of *caprification*. The fig tree is distinguished from all other trees, with which we are acquainted, by its bearing two successive and distinct crops of fruit in the same year, each crop being produced on a distinct set of shoots; but this climate rarely allows the second crop to come to maturity, except where they are forced by hot-house culture.

The *caprification* of figs was practised by the ancients in the same manner as it is now attended to by the inhabitants of the Archipelago; and it is described by Theophrastus, Plutarch, Pliny, and other authors of antiquity. It is too curious a circumstance in the history of the fig tree to be omitted, as it furnishes a convincing proof of the reality of the sexes of plants. In the cultivated fig, the receptacles are found to contain only female flowers, that are fecundated by means of a kind of gnat (*culex, L.*,) bred in the fruit of the wild fig trees, which pierces that of the cultivated, in order to deposite its eggs within, at the same time diffusing within the receptacle the farina of the male flowers; without this operation, the fruit may ripen, but no effective seeds are produced. Hence it is, that we can raise no fig trees from the fruit of our gardens, having no wild figs to assist the seed. They are consequently raised by cuttings, layers, suckers, roots, and by ingrafting; the most general method is by layers or cuttings, which come into bearing the second and even the first year.

In many parts of the Grecian Islands, the inhabitants pay such attention to the caprification of the cultivated figs, that they attend daily for three months in the year to gather these little flies from the wild fig trees in their gardens, by which means they not only get finer fruit, but from ten to twelve times the quantity; thus one of the most minute insects is, by the attention of man, made a principal cultivator of fruit.

It is a curious fact, that freshly killed venison, or any other animal food, being hung up in a fig tree, for a single night, will become as tender, and as ready for dressing, as if kept for many days or weeks, in the common manner. We are told of a gentleman, who made the experiment of suspending a haunch of vension which had lately been killed, in a fig tree when it was in full foliage, at about ten o'clock in the evening, and was removed in the morning before sunrise, when it was found in a perfect state for cooking; and he adds, that in a few hours more, it would have been in a state of putrefaction.

We import the best dried figs from Turkey, Italy, Spain and Provence. In the south of France, they are prepared by dipping them in scalding hot lie, made of the ashes of the fig tree, and then dried in the sun.

The most suitable kind to raise in Great Britain or the northern parts of the United States, is the Brunswick fig, (*Ficus Indica.*) In a south east corner, trained against a wall, it ripens in England by the middle of August, and about a month

*Voyage from Montreal to the Frozen and Pacific Oceans. London, 1801. †Massachusetts.

later in New England. It is necessary, however, in this country, to secure it from the frosts during the winter, and to remove it as early in the spring as the season will admit. The leaves are very deeply five-lobed. the lobes narrow, and of nearly equal width. The fruit is very large, obovate, fleshy, with an unusually oblique apex. The eye is rather depressed. The stalk short and thick. The skin pale green on the shaded side with a tinge of yellow; next the sun, dull, brownish red, sprinkled with small, pale brown specks. The flesh is pinkish in the interior, nearly white towards the skin, but chiefly semi-transparent reddish brown, extremely rich, sweet and highly flavored.

THE SUBSOIL PLOUGH.

The subsoil plough was designed, some nine or ten years ago, by James, Smith, Esq., of Deanston Cotton Works, Stirlingshire, for the purpose of opening up the close subsoil of the farm of Deanston. In the design, two essential points were kept in view—first, the construction of an instrument that would effectually open up the subsoil, without throwing any of it to the surface, or mixing it with the active or surface soil; second, to have an implement of the easiest possible draught for the horses, while it was of sufficient strength and weight to penetrate the firmest ground, to a depth varying from fifteen to eighteen inches, and resist the shocks on the largest stones. This plough is, therefore, on a gigantic scale, in comparison with the light ploughs in ordinary use. Its extreme length is fifteen feet. From the socket at the point of the beam, to the first stile or upright, six feet; from thence to the back of the second style, nineteen inches; from thence to the outer end of holding handles, seven feet; from the sole to the bottom of beam at stiles, nineteen inches; length of head or sole bar, thirty inches; from heel of sole to point of sock, forty six inches; broadest part of sock, eight inches. The coulter is curved; and, in order to prevent its point from being driven from its place by stones, it is inserted to the depth of an inch in a socket. The lateral dimensions of the sole-piece are two inches square, this is covered on the bottom and land side with a cast-iron sole-piece, to prevent wear. The sock goes on to the head in the usual way, and from its feather rises the spur-piece, for the purpose of breaking the subsoil furrow. When the subsoil consists of very firm clay, or other hard and compact earth, the feather and spur-piece may be dispensed with, and a plain wedge or spear-pointed sock, such as those of the old Scotch plough. may be used. The draught bar, of one and a quarter inch round iron, is attached to the beam at the strong eye, and, passing through an eye in the upright needle, is adjustable to any height or lateral direction, being moveable in the socket, at the point of the beam, and can be made fast at any point by a pincing screw, wrought by the lever. By the proper setting of the draught rod, the direction of the power of the horses is so regulated, as to render the guiding of the plough easy at any depth or width of furrow. The beam is about five inches deep at the middle, and one and a quarter inches in thickness; towards the draught end, it tapers to three inches deep, and one inch thick; at the holding end, where the handles branch off, it is two inches by one. The whole, being iron, weighs four hundred and forty pounds, imperial. This appears an enormous weight, and most people are alarmed at the strength and weight of the implement; but, after repeated trials with lighter ploughs, those of the dimensions and weight now described, have been found to be at once the most efficient, the most easy of draught, and the easiest for the ploughman to manage. Four ordinary farm horses are generally sufficient to draw this plough, in breaking up subsoil of ordinary firmness; but, on very tough clays, or in hard till, it may be found necessary to use six horses. When four are used, they are yoked two and two, by draught bars and chains. When six are used, they are yoked three and three, by draught bars and chains. The main chain, for the leading horses to pull by, is hung, in both cases, by links from the collars of the rear horses, to keep it up from their legs, and the trace bars of the leaders are kept close up to their hams, by cross-straps on their quarters. *Chambers'* [*Edin.*] *Journal.*

From the British Farmer's Magazine.

ON THE VARIOUS IMPLEMENTS USED IN HUSBANDRY.

Every operation required in the cultivation of the ground is much facilitated by the use of proper implements and tools. The aration of the surface is one of the most important operations; and, of late years, mechanical science has been much employed in assisting the plough and wheelwrights to construct their machines on the best principles; and yet, perhaps, we have not arrived at the *ne plus ultra* of invention.

In early times ploughs were, as they still are in uncivilized countries, of the rudest construction; all that was done, or expected of them, was merely to stir, or rather scratch the surface across and across, till a thin stratum of mould was obtained to half cover the seed cast thereon.

In process of time, and especially since horses were employed in husbandry, ploughs became much more complicated machines, fitted with iron shares and coulters, with handles, mouldboards, and carriages on wheels for supporting the beam, and by which the share was elevated or depressed according to the required depth of furrow. These carriages were invented for relieving the ploughman in ploughing gravelly clays, or very hard, tenacious soils, where the share must necessarily be set deep to keep it in the ground, and prevented from going too deep by the moveable bolster of the carriage.

But the action of the plough in passing easily, and the position in which the turned furrow or flag is laid, has called for the greatest ingenuity in the construction or inclination of the mould-boards of ploughs. There are several effects required in the action of ploughs. The first is, simply removing a slice of about nine inches wide, and laying it upon a space of equal width to the right of the plough. Secondly, it is required that the slice should not only be removed, but completely turned upside down. Thirdly, that it be not only removed and turned, but as much shattered as possible in the act of turning. All these effects are produced by the form of the mould-board and point of the share. The latter is pointed, and acts like a wedge; and, together with the sheath to which it

is attached, is upright or perpendicular on the land side, (that is, the firm or unploughed side,) and bevelled off on the work side, where it unites with the four-edge of the mould-board, or breast of the plough. The mould-board is either convex, concave, or twisted. In whichever form the acting face of the breast may be, it is always set at a less or greater angle from the line of draught. A convex mould-board is a thick slab of tough wood, two or three feet in length, and a foot or fourteen inches wide. It is worked or splayed off before, where it is fitted closely to the beam and sheath in front, and held out nine or ten inches from the line or draught behind, by pins inserted into the tail of the beam. This, and all other wooden mould-boards, are faced with plates of wrought iron, bent to the shape and nailed on. These boards have, moreover, what is called a *ground-rise;* that is, a bar of iron one inch square, bent similar to the mould-board, having a spur before, by which it is fixed to the share, and an upright wing behind, by which it is nailed to the tail of the board.

From the position of this breast, it may easily be perceived that its action through the soil is only to *push aside* that opposed to it, and is particularly useful in working clean fallows where no turning is required. This plough has also a peculiar rubbing or grinding action upon the clods which it moves, tending to reduce them to powder—a most desirable effect.

A concave breast is narrow and contracted at bottom, and hanging over at top, particularly at the after part. This first raises the slice from its bed, and in its progress gradually turns it completely over; and is most effective for burying a crop of weeds or stubble.

But the most approved form of mould-board is that called the *twisted breast*, and for the manufacture of them in cast iron, several patents have been granted by government. They are said to unite ease of draught with effective work, in turning the slice not completely over, but laying one upon another at an angle of about thirty degrees, thereby leaving a right angle of the slice to be acted on by the harrows. These ploughs are favorites with ploughmen, whether used with wheels or swinging; because they make, when well held, remarkably neat and regular-looking work, particularly in ploughing leys, or in breaking up old sward. It is true they clear the furrow completely, and the slice is sufficiently turned—the grass undermost—and laid in the best position; but the slice is so *entire*, from end to end, that it may, if the sward be tough, actually be, as the ploughmen say, "drawn out of the field."

The slice being raised and turned so neatly in one entire piece, can be of no advantage to the crop; because the body of the slice remains as firm and *compact* as it was before the operation; and it is only among the loose mould raised by the harrows, that the seed can be nourished during the first stage of its growth. Another defect of these neat working ploughs is this: as each slice leans upon the former, there is a small angular vacancy under each, and which, when slugs are plentiful, form secure retreats for these destructive animals. Hence, the necessity for heavy *pressers* to consolidate the soil between the furrows, in order that the seed might have a firm bottom to lie on, and not hang loosely on the interstices.

That the surface of the soil being turned over in such entire slices is unfavorable to the crop, is exemplified by the great difference observable in the results of crops raised on ground stirred by the plough, and that digged with the spade. The superiority of the latter is entirely owing to the more perfect comminution and disruption of the soil, by which all atmospheric influences are more readily admitted, and an ampler space given for the more easy range of the roots. It is manifest, therefore, that the more the slice is disturbed and shaken in ploughing, so that the grass and weeds are sufficiently buried, the better it is for the crop. And it is questionable, whether leys would not be better ploughed for wheat or peas by the convex boarded plough than by the twisted breast, even if it were necessary to hand-pick the weeds off afterwards.

It is perfectly true, that when wheat or any other crop is intended to be drilled, the surface must, in the first place, be deeply harrowed, which in a great measure obviates the objections made to the twisted plough laying the surface so firmly together. But if not harrowed equally deep for broadcasting, the crop will certainly be inferior—rising and ripening unequally.

The coulter is an efficient member of the plough; it is placed a little in advance of the point of the share, and cuts through the turf, or matted surface, while the share is slipping under and raising the slice from its place. The coulter is always set a little into the land. The skim coulter will be noticed hereafter.

Much has been written on the most suitable length of the mould-board, and at what angle it should project from the line of draught. The working part of a plough has always been formed on the principle of a wedge, having one straight side to correspond with the line of draught, and the other diverging from that line at an angle more or less acute. But the action of a plough and a wedge are not exactly similar; the last operates in the cleft along its whole length, while it is the forepart or breast only of the first which is constantly acting, and where the principal force or impulse of the machine should be concentrated. A wedge has a double lateral action, while the plough has but one. Loose soil may be considered a fluid; and, we are quite certain, that all solid bodies impelled through a fluid move with greater celerity with the *large end foremost* than with the smaller. As proof of the truth of this fact, we need only appeal to the general form of birds and fishes; and even the finest graduated wedge itself may be impelled easier through water with the base, rather than the point, foremost. The form of ships is proof. A mast, or spar, as seamen call it, is towed with the greatest difficulty with the small end foremost.

From these observations it will appear, that the greater the length of the sole or share-tail be, the *steadier* will the plough move in the work; and the longer the mould-board, to open a furrow of nine inches, the *heavier* must be the draught. And, moreover, it appears, that a mould-board fourteen inches long, set at an angle of forty-five degrees from the line of draught, would open a furrow nine inches wide with much more ease than a board three feet long, to open the same furrow.

These particulars are worth the attention of the plough-wright; for, notwithstanding all our im-

provements in plough-making, there is still room for amendments, either in lessening the draught, or making the operation more effectual for the purposes of the farmer.

Different soils require very different kinds of ploughs: in light, loamy soils, lightly-constructed swing-ploughs, drawn by two horses a-breast, and without a driver, are the most convenient and economical. In strong, heavy clays, both ploughs and teams must be proportionably strong. Land of a thin staple, and on a gravelly subsoil, requires skeleton-formed ploughs, having a share fixed on a sheath, with a long ground-rise, secured by a tuck behind. The only parts of this plough in contact with the pan of the soil, while at work, are the point of the share and the two rises; for if the bottom were not open, the plough would be every instant thrown out of the ground.

It is impossible, however, to describe the many different kinds of ploughs in use in these kingdoms; every district having its own plough-wright, his ploughs are said to be the best in England. It is quite true, that local circumstances impose on the resident tradesman the task of forming his ploughs to the work required to be done; but, we very often find him wedded to his father's plans, rather than altering them to suit the more ameliorated state of the soil. On this subject one thing is perfectly clear, and that is, the working of the land may be effected by much lighter implements, and less horse-strength, than as it is now practiced.

A FARMER.

From Jameson's Edinburgh Philosophical Journal.

FRIBOURG BRIDGE.

The town of Fribourg is built on the left bank of the Savine. Both sides of this small stream are very steep, and rise to the height of about 220 feet (English) above its bed, and travellers from Berne to Fribourg were formerly obliged to descend the hill in order to reach a small wooden bridge which crosses the river, and immediately after, by a steep ascent of about 220 feet, reach the top of the opposite bank before coming to the centre of the town. The passage through Fribourg thus occupied nearly an hour; but the case is changed since the erection of the new suspension bridge. These difficulties were long considered the unavoidable consequence of the local situation of the town, until some bold spirit conceived the idea of uniting, by means of a suspension bridge, the steep banks of the Savine. It was necessary that the bridge should pass over a great part of the town itself, and the scheme was considered completely Utopian; yet, certain of the authorities and some active citizen determined to submit the measure to the consideration of engineers of different districts. Various designs were accordingly offered, and the government of the canton gave the preference to that of M. Challey, of Lyons, whose plan has since been executed under his immediate superintendence.

The gateways at either end of the bridge are of Doric architecture, and are about 65 feet high. The tops of their arches are about 42 feet above the roadway, and the arches have a span of 20 feet. The masonry of the gate is 46 feet in width, and its thickness is about 20 feet; and although the hardest blocks of the hard limestone of Sura were employed in this work, iron cramps were used to complete the union of the stones, and about 24 tons of iron were used for this purpose.

The width of the valley of the Savine at the point where the bridge is built, or, in other words, the distance between the inner face works of the two gateways on either bank of the river, and consequently the span of the suspended roadway is 871 feet. It may be easily conceived that a good deal of doubt was entertained as to the propriety of trusting to a span of so great extent, and the idea of suspending the bridge at the middle, at first occured to M. Challey, as the best mode of forming the communication. On weighing the difficulty, however, of obtaining a solid foundation for a pier 220 feet in height, in the bottom of an alluvial valley, he soon relinquished this idea; and the bridge has, therefore, been constructed with a single span of 871 feet.

The road-way is suspended in the manner now universally known, by four cables, of iron wire, (in France ropes formed of wire are employed, and not solid links as in England,) passing over the upper part of the gateways. Each cable consists of 1200 wires, each about 1-10th inch in diameter, and about 1400 feet in length. To avoid the difficulty of moving these heavy cables, each wire was brought separately to its place, and there united on the spot by the workmen, who were suspended during the work. We are happy that no accident of any kind occurred during the operation. It is calculated that the four united cables are capable of sustaining a weight of 2946 tons. The four cables are fixed in chain fits or shafts cut out of the solid rock, on either side of the river—on each of these fits four cables pass through a vertical cylindric chimney or pillar, which bears three heavy domes resting upon it, and at the same time abutting against grooves, cut with much care in the rock, to receive the springing stones. At the bottom of the pillars, the cables are made fast to blocks of very hard stone, which are cubes of 6½ feet. The cables therefore cannot slide without lifting the whole of these enormous buildings, strengthened as they are by their connection with the solid rock.

M. Challey began this work in the spring of 1832. He brought out of France with him only a foreman, who had assisted him on former occasions, and engaged in this arduous work with the inexperienced workmen of the country, who had never seen a suspension bridge: he completed the work in spite of all these difficulties, and on the 15th October, 1834, fifteen pieces of artillery, drawn by 42 horses and surrounded by three hundred persons, crossed the bridge, though they united in one body as well on the middle as on the ends of the road-way. Nor was the least appearance of derangement discovered on the closest examination. Some days after, the whole of the inhabitants of Fribourg and its suburbs passed over in procession, so that there were no fewer than 1800 persons on the bridge at the same time, and all classes, of travellers, mercantile and curious, have since united with the natives of the Swiss cantons in testifying their entire satisfaction with the bridge. Although the severe proof to which the constructor of this new work subjected it, by loading the road-way with about 20 pounds on each square foot, did not take place, till the month of October, 1835, yet it may safely be said that the collossal bridge of Fribourg was completely finished in two years and a half. The whole expense was only about £24,000 ($115,000.)

The only bridge which can be compared for its dimensions with that of M. Challey, is the Menai or Bangor bridge, which joins the Isle of Anglesea to the main land of England. The largest vessels sail below it with full canvass set. It was constructed by the celebrated engineer Telford; but the Menai bridge is only five hundred and fifty feet in length, while the bridge of Fribourg is eight hundred and seventy-one. The roadway of Mr. Telford's bridge is about one hundred and six feet above the level of high water, and M. Challey's is two hundred and twenty above the level of the river Savine.

Comparisons with certain points in the city of Paris give a more lively idea than any numbers of the magnitude of the work. Only conceive a bridge of one arch as long as the railing of the Carousel, and a road-way as high as the tower of Notre Dame, or the column in the Place Vendome, and you may have some idea of the bridge of Fribourg.

From the Mining Journal.

DEEPEST MINE IN GREAT BRITAIN

Our readers may perhaps recollect, that some time ago a coal pit, said to be deepest in Great Britain, was sunk at Monkwearmouth, to the depth of 264 fathoms, or 1,584 feet below the surface;* and that in November, 1834, Professor Phillips of New York, along with a number of other scientific persons, descended the pit, and made a series of very interesting observations on the variations of the barometer and thermometer in the course of their descent and ascent. The temperature, by these observations, increased in proportion to the depth, and a thermometer sunk into a hole, drilled to the depth of two and a half feet into the floor of the workings, from which hole the air was carefully excluded, after remaining in that position forty-eight hours, stood at 71,2. Since the date of Professor Phillip's visit, the enterprising owners have sunk it still deeper, and the average temperature has increased to seventy degress, a degree of heat which makes it difficult for the men to work beyond six hours at a time.† In addition to this inconvenience, a species of fly, about an inch long, has appeared, by the bite of which both men and horses are much, annoyed.

From Loudon's Gardeners' Magazine.

OWEN'S ANIMALIZED CARBON.

Five or six years ago, Mr. Owen happening to be at Copenhagen, and observing that the emptying of the privies, and the bones, and such like domestic refuse, had been for many years, perhaps for centuries, deposited in four or five large pits in the outskirts of the town, conceived the idea of using it as manure. He purchased the contents of all these pits, and is now selling it in the form of compressed powder, as a most valuable manure, which it doubtless is. In 1835, 700 tons of this manure were sent from the manufactory at Copenhagen; in 1836, 1600 tons, and in 1837, up to about the middle of June, when our informant, Mr. Petersen, left Copenhagen, 3000 tons were exported.

From the Farmers' Magazine.

NEW MANURE.

To the Editor of the Mark Lane Express.

Sir.—I notice in your valuable paper of the 15th inst., you allude to the unquestionable and eminent chemist, Lavosier, as to the example in cultivating lands on chemical principles. I have had ocular demonstration of the fact, both in France and England; and am sorry the limit of time prevents me giving you a more lengthened account, which I shall have pleasure in doing in a short period; and I beg to state, from the knowledge I obtained in France, and regular correspondence since I left that country, added to which the successful experiments that have been followed in England; it will not be difficult to prove land managed with chemical compost we should ultimately produce one-sixth more grain and seeds than we do this time, without any additional expence to the farmer. Referring you to the annexed,

I remain, sir,

Your obedient servant,

J. H. SHEPHERD.

Unslet, June 15, 1837.

IMPORTANT TO FARMERS.

Patent animalized black, which has proved so effectual in all parts of France, where adopted, for upwards of eighteen months back, possesses the following advantages over bone manure:—

Firstly, It is applicable to the strongest as well as the lightest soils.

Secondly, One ton is equal to thirty tons of common fold-yard manure; can be drilled with the present drills as used for corn or seed; or applied as a top dressing, immediately after the plant appears above ground.

Thirdly, The proportion is as half a ton English per hectare French, being equal to about two acres two roods English land measure.

Fourthly, Insects do not lodge in carbonized substances, the animalized black being nothing else.

Fifthly, To use half animalized black, and half boiled bone-dust, is a certain preventive against insects.

Lastly, Five cwt. of animalized black costs no more than the same weight of bone-dust, but produces much greater *effect*, in point of produce, on all soils.

N. B. It is necessary to state, to prevent misunderstanding, this is a different manure to what is selling for animalized carbon, as a sample of the latter was taken by the writer from a sea-port in England, and given to one of the first French chemists to analyze, who pronounced it not to have a particle of carbon in it, observing, at the same time it possessed qualities superior to bones, as the latter he called the refuse of the animal.

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* There are more shafts than one at the Consolidation Mines in Cornwall, which are nearly 300 fathoms in depth, or 1800 feet.

† At the bottom of Wolf's shaft, at the Consolidated Mines, the temperature is said to have been as high as 96.°

FISHING WITH BUCK-EYE.

It may be already known to some of our readers, but it was new to us to learn that the shrub called buck-eye was fatal to the fish of our rivers and creeks. Peter Dick says he and Dr. J. M. Worth tried the experiment very successfully a few days ago, in a little pool of water, on the Doctor's plantation of Montgomery county. The only preparation consisted of a basket part full of the leaves, roots and balls of the buck-eye, beat and bruised up together and then dipped a few times into the water; when instantly the fish, big and little, began to throw themselves simultaneously on the shore. This pool, of not more than three or four rods surface, is not far distant from a creek; but there did not appear to have been any connexion between them, even in the times of high water. In this way they caught 230 fish in a few minutes. And some hundreds more of the smaller order lay round the margin of the pool. The fish were so stupified that they made no resistance in being caught in the hand.—*Ashborough (N. C.) Citizen.*

From the Lexington (Va.) Gazette.

REMARKABLE ATTRACTION OF BIRDS.

"Birds of various kinds, are seen to fly with such impetuosity against a certain house not two miles east of Brownsburg, in this county, as to extinguish life instantly. The walls are stuccoed, and washed with a beautiful white lime. In one instance, a pair of partridges, rushed with great violence against the wall, and fell dead instantly. On examination, it was ascertained, that the craw of both had burst by the concussion. Two doves, on another occasion, met a similar fate. Larks, sparrows, robin red breasts, with other of the feathered tribe, are alike the victims of this fatal encounter. The number of dead picked up, does not fall short of thirty. It would appear, that the exceeding whiteness of the walls destroyed the instinctive sense of danger. In no case noticed, has an individual escaped death, whose flight was directed towards the building."

[The foregoing communication is from one of the most respectable gentlemen in Rockbridge, whose statements need no confirmation from any one. We have, however, the most abundant confirmation of his assertions from other equally respectable sources. We know not why we should not state that the house referred to, is the residence of Capt, Henry B. Jones, who communicated the facts to our informant. Ed. Lex. G.]

From the Gardener's Magazine.

HINTS ON RAISING ASPARAGUS.

By John Wighton, Gardener at Cossey Hall.

Asparagus, grown in the gardens of private gentlemen, is often inferior to that raised by market-gardeners. The superiority of the latter is caused by the greatest richness of the soil, in which it is raised. Market-gardeners being under no control of masters, generally spare no expense in enriching their soil; and their beds are more frequently renewed. But gentlemen's gardeners, not being always free to act as they judge most proper, are often without the means of improving the soil; their beds are frequently old, and the soil in them exhausted; when new beds are made, from the want of more materials, they are generally formed in the same way which prevailed fifty years ago. The soil is made good about two feet deep, and laid out in beds four feet wide, with paths two feet wide between them; the plants being set in rows one foot asunder. Treated in this manner, no asparagus will be fit to cut before three years; and by that time the beds will have become a mass of roots, and two or three years afterwards the soil will be exhausted.

To raise large asparagus, the soil should be made good to the depth of five or six feet; then laid out in beds from four feet to six feet wide, with paths between them, of the width of two and a half feet. The plants must be put in two feet apart, and the stems not allowed to approach each other much nearer than two feet; or beds three feet wide, with one row of plants down the centre, and the plants one and a half feet asunder in the rows would be preferable. It is a very common error to allow too many stalks to grow close to each other. If this be permitted, however good the soil, the asparagus is sure to be small; as the stalks, when so close, draw upon each other. Weak and small stems produce invariably weak asparagus; for it is at the bottom of these that the asparagus springs.

Happening, lately, to take up some asparagus, which had been planted five years, I found the roots at the depth of six feet, in a poor sandy soil.

Cossey, Feb. 10.

From L'E'cho du Monde Savant.

EFFECT OF FORESTS ON THE SIZE OF RIVER CURRENTS.

M. Boussingault, in a memoir recently presented to the Academy of Sciences at Paris, has endeavored to show the effects which the clearing away of forests has upon the force and abundance of the river streams in a country. He thinks that the current of water diminishes in proportion as the clearings extend; and was led to take this view from observation made in America, especially in the lake of Tacarigna or Valencia, in Venezuela, which has no outlet. This lake, in fact, diminished in depth as fast as the forests were grubbed up; but as soon as, on account of political troubles, the grubbing up ceased, the waters began to assume their primitive level. Similar results have been furnished by the Lake of Ubate, in New Granada, and even by those of Switzerland.

M. Boussingault also thinks that clearing away the forests has a direct tendency to diminish the quantity of rain. In the provinces of San Buenaventura, of Choco, and of Esmeralda, which are situated to the south of Panama, and where rains are almost continual, the soil is covered with thick forests; whilst towards Paita, beyond Tumbez, the forests have disappeared, and rains may be said to be unknown. This want of rain is in like manner observed in all the country near the desert of Sechara, and even to Lima; yet these

two countries enjoy the same temperature, they present nearly the same surface, and have a like position relatively the mountains.

M. Arago remarks that a contrary result has been observed at Viviers, in the department of Ardèche, where the quantity of rain fallen has augmented since the clearing of the forests from the country.

On the other hand, M. Devèze of Chabriol has come to the conclusion, from the examination of several historical documents, that in the department of Cantal, in the environs of Saint Fleur, there has been an abatement of temperature since the disappearance of the forests. For example, from the records of the 13th and 14th centuries, it is proved that at this period the vine was cultivated on the slope of the hill of Saint Fleur, and this culture will not succeed at present. The chestnut has also disappeared from many of the cantons where it formerly flourished; and many villages situated near the summits of mountains have been abandoned. It is also remarked that, in this country, many streams have been dried up, in consequence of the clearing of the forests.

PURIFICATION OF TAR.

Tar contains a certain quantity of pyroligneous acid from the wood which produces it, and which in time occasions the destruction of cordage by thickening, in the manner of pitch, as soon as the oily portions have disappeared. This change prevents the threads from stretching, and of course they must break, although they may still be sound. The acid should therefore be carefully extracted from the tar. This is effected by washing it in clean lime-water. They are to be well agitated together in any suitable reservoir, by a convenient instrument of any kind, changing the lime-water frequently, and continuing the operation until a good test paper indicates a freedom from all acidity.

Tar thus purified is a good preservative of wood, which it defends from decay much longer than common tar, because the acid attracts moisture from the air, and retains it in the fibres of the wood; but purified tar repels moisture, and thus acts as a preservative.—*Jour. des Conn. Usuelles.*

From the British Farmer's Magazine.

MANUFACTURE OF BEET-ROOT SUGAR IN FRANCE.

From the French of M. Dubrunfaut and others.

[Continued from p. 91]*

CHAP VI.

Concentration of the Juice.

If after defecation, the juice were only a crystallizable matter, composed but of liquid sugar and water, all that would be necessary could be accomplished by evaporation. But this is not the case, for when the juice is submitted to this operation, it soon becomes turbid, though clear at first, and presents to the eye a number of lumps similar to those produced by defecation, and which are held in solution, and only precipitated as the water evaporates. These solid particles contribute to the alteration which takes place in the sugar. One inconvenience attending them is this: that if it were wished to proceed at once to boil the juice without interposing between the defecation and this same boiling, some process by which the syrup can be purged from the impurities which are held in suspension in it, we should obtain nothing but a thick substance which would burn before it perfected its sugar, and from which, in fact, not an atom of crystallizable matter could be extracted. It is this circumstance which distinguishes, in beet root sugar works, concentration from boiling; otherwise these two operations have the same end in view: namely, the separation of the water from the juice by evaporation. The *difference* between them in the order of the proceedings is—1. That concentration precedes boiling. 2. That the one operates on larger bodies than the other. 3. That the process of clarification intervenes, the object of which is to separate the substances precipitated by concentration, in order to produce a clear, limpid juice for boiling. 4. That the concentration takes the juice at the density of defecation to carry it to 20 or 25° hot, while boiling takes it at this density to carry it to 40 or 41° (areometrical,) a point nearly sufficient for a good crystallization.

The process of defecation generally causes a loss in the weight of the raw juice of 1° or 1½°; for instance a juice that weighed 7 areometrical degrees at 10° (55°) of the thermometer, would not weigh, after defecation, more than about 6°. If it weighed 10° the defecation would reduce it to 8½°; in fact the loss of weight in this case is nearly in proportion to the density of the juice.

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* The delay of our continuation of this article has been caused by the miscarriage of the No. of the European journal, next in order, from which we copy. If the loss had been total, we should not only have been placed in the disagreeable position of commencing an article without being able to complete it, but, unwittingly, had seduced sundry of our brethren into the like difficulty; for nearly all the editors of agricultural papers in this country have copied the commencement from the Farmers' Register, relying of course upon this journal for the means to furnish to their readers the conclusion. So far as we know and believe, the copy of the British journal from which we take this piece is the only one received in the United States. And therefore, if we had remained under the privation of the loss of the continuation, all those who have profited by our provision in this matter, would have been placed in the same awkward predicament.

No pains and expense have been spared, on our part, to obtain the best foreign agricultural periodicals, and other new agricultural works; and yet none of our efforts have been attended with more disappointment. Delays in receiving new publications are generally encountered, and total losses frequently, and we pay for all lost packages, as well as all received. And after all the cost, and the trouble added of selecting articles from the mass of worthless matter, the pieces so selected are copied into other agricultural journals of this country, and generally without the slightest acknowledgment of the source whence they are immediately derived.—Ed. Far. Reg.

Concentration operates by the intervention of fire, which reduces the water to the state of vapor; and as the tension of vapor is regulated by the temperature, it follows that, to produce the quickest possible evaporation, under the atmospheric pressure, it will be necessary to expose it to the highest temperature that it can take under this pressure, which is that of ebullition.

There are other methods of producing concentration. Achard, for instance, by steam, (not high pressure,) acting on the boiler which contained the juice to be evaporated. This he effected without ebullition, but very slowly. In England syrups are often evaporated by means of steam; but there it is so highly compressed that the liquor enters into ebullition as if it were exposed to a naked fire. All these means of evaporation are more or less complicated, and on that account rather deviate from the common routine of agricultural operations. The author therefore confines himself to the most simple mode of evaporation for concentrating the juice of the beet root. The great problem is,

"To exhibit the simplest apparatus for concentrating the juice in the shortest possible space of time, and with the least alteration in the quality."*

§ 1. *Of Evaporating Apparatus, or Boilers for Concentration.*

Boilers of copper are thought to be the most suitable for this purpose. It has been proved both by theory and practice that the vaporization of liquids is best effected in wide open vessels. It is then important that the evaporating surfaces should be as large as possible, and exposed to the direct action of the fire. But herein a difficulty presents itself, which is this:—

The beet root juice will suffer by concentration a reduction nearly equal to four-fifths or five-sixths of its volume, according to its richness, and this reduction ought to take place in a very short time, which, of course, is only to be effected by a fierce fire. The great difficulty in this case is to prevent the sugar from burning. But the better way perhaps will be to give a brief analysis of the several modes actually in use.

1. *Achard's Plan of Concentration.*

This chemist recommended from experience the concentration by steam, for which purpose he had two boilers placed for one defecating boiler. These were charged only about six inches deep, consequently the process is very slow, and, in the author's opinion, by no means advantageous to follow.

2. *Plan adopted at Chatillon-sur-Seine.*

Here the concentration is effected in boilers equal in capacity to those of defecation, thus each defecating boiler has its evaporating boiler. The process of concentration requires ten or twelve hours to bring the juice to 22 areometrical degrees boiling. This is a very imperfect system.

3. *M. Chaptal's Plan of Concentration.*

This chemist employs one evaporating boiler for one of defecation, and this boiler, 15 inches deep, receives all the juice of one operation. The surface of this boiler is calculated to contain about 8610 English square inches, (555½ square decimetres) capable of evaporating per hour as many killogrammes of water (555½ killo = 1221lbs.) M. Chaptal concentrates the syrup to 28° boiling, which corresponds with 32° cold. To obtain this result it was necessary to reduce the body nearly to a sixth, which would require three or four hours, a period considered to be too long. M. Dubrunfaut therefore does not advise a single boiler for this operation.

4. *Plan of Concentration generally in Use.*

This method consists in the adoption of two evaporating boilers, for one of defecation. All three have bottoms of the same dimensions; and as the two former are capable of receiving all the juice furnished by one defecation, they are made rather more than half the height of the latter. Thus admitting that the one contained 2000 litres, (70 cubic feet,) each of the others would contain rather more than 1000 litres, (35 cubic feet). This plan is practised at many of the manufactories. Still some are of opinion that it is not the most advantageous to adopt.

5. *M. Crespel's Plan of Concentration.*

Each boiler of concentration is 2m.32 (about 91 inches) long, and 1m.06 (39 inches) wide, and presents a surface of 3600 square inches. There are six of these for one of defecation. An evaporation takes place during the defecation of about an 18th part of the mass.* About 280 to 300 litres (62 to 67 gallons) are poured into each concentrating boiler, which is nearly four inches deep. The juice is kept boiling till it had reached 31° of Beaumé. This operation will require five hours. The 1800 litres (400 gallons or so) contained in the six concentrating boilers will be reduced to 220 or 240 litres (50 or 54 gallons) of syrup, according to the richness of the beet roots in saccharine matter.

The above is M. Crespel's own account, but since it was written he has made many improvements, and particularly in his evaporating apparatus, which is composed of two rows (*batteries*) of six boilers each, forming a set for each of the two defecating boilers with which they are intended to act.

Each of these boilers may be about four feet in diameter by one foot in height. The following is the mode of using them: The charge of one of the defecating boilers being drawn off clear, is distributed by equal portions over the six boilers which compose one of the *batteries*. They are then submitted to a brisk evaporation till the juice has acquired a density of 20° or nearly so. The contents of the six boilers are then united in one, to be clarified, which process will be described hereafter. The concentration thus advanced but to 20° (areometrical,) does not expose the juice to the risk accruing from too thin a body.†

This M. Dubrunfaut thinks the best plan he had hitherto seen adopted, although in his opinion it

* In the process of boiling, great improvements have recently been made in France, steam being now generally employed for that purpose in the several sugar establishments.

* This reduction arises not so much from evaporation as from the scum and froth removed during the defecating process.

† M. Crespel, I am informed, has materially altered his plan since this was written.

still admitted of improvements. He therefore proposes the following as his own :—

6. *Plan of Concentration.*

It has received the sanction of experience, and will be particularly advantageous in large concerns: three boilers are supposed to be necessary, each affording a charge of 500 litres (114 gallons) every half hour, making 24,000 litres, or 5472 gallons in the 24 hours.

The author has ascertained that the syrup, to undergo a suitable evaporation, ought never to present in the boilers a layer reduced to more than 5 centimetres (2 inches) in depth. This is the minimum of reduction to which it can be brought without danger; for beyond that, the ebullition will not operate well.

It is well known that to produce the greatest evaporating effect, the juice ought to be spread over the largest possible surface, but that this must necessarily be limited by the reduction in bulk which the juice will undergo in concentration. The inconvenience arising therefrom is overcome in the following manner. First, the juice is so distributed over the surface as not to complete its evaporation there; but when the layer shall be reduced to 5 centimetres (2 inches,) this same juice is removed to a vessel presenting a smaller surface, and where, consequently, it undergoes a new evaporation; then, when on this new surface it shall again be reduced to 5 centimetres (2 inches,) it is removed to another still smaller, and so on. However, three of these removals have been found to be sufficient, in the progress of which the juice has been exposed to the action of the fire but an hour and a half.

It will be well to ascertain the quantity of water evaporated from a given quantity, say 500 litres (114 gallons) of juice, the mean richness of which is 6 areometrical degrees, and which by concentration is raised in density to 30 degrees when cold. A calculation is then given, by which it appears that these 114 gallons will be reduced to 18½ gallons (82 litres,) 9 gallons of which are water. There must then have been evaporated during the concentration 95½ gallons = 919 lbs. of water.

In adopting vessels of three different calibres to effect the concentration of 500 litres (114 gallons) of juice, and the consequent evaporation of 95½ gallons of water in half an hour, it has been taken for granted that the boilers were worked simultaneously and continually. It would, of course, be necessary in such case, that they should be discharged and recharged every half hour. But in order to do this properly, their evaporating surfaces should be exactly proportioned to the quantities of liquid received by each of them, and to the effect which they are intended to produce. Thus the first (500 litres) ought to have an evaporating surface equal to 861 square feet. The juice will be distributed over a bed of 10 centimetres (4 inches) in depth, and as it ought not to continue in a state of ebullition more than half an hour, after this time it will have lost half its bulk of water, and will thus be reduced to 5 centimetres (2 inches) in depth. The juice will then be transferred into a second boiler, the surface of which will be equal to 430 square feet. From thence it will be removed to a bed 4 inches deep, as in the first instance, and after evaporating half an hour this will also be reduced to 5 centimetres, losing in the above time 275lbs. of water. There then remain 28 gallons of syrup, which will be taken to a third boiler, presenting a surface of 215 square feet. This last vessel will be capable of evaporating 14 gallons in half an hour, making a total of 437 litres (100 gallons) of water evaporated, whereas only 95½ gallons were wanted. If the size of these vessels be objected to, it is very easy to provide against this evil; for instance, instead of one boiler of 860 superficial feet, one might employ four of 215 feet, and in place of No. 2, which is said to contain 430 square feet, two of 215, and so on.

§ 2. *Of the Appendages to the Evaporating Vessels*

The walls of the furnaces ought to be strongly built, and protected on their upper edges by sheet copper.

A skimmer is wanted for each boiler, proportioned to their respective sizes, and also some good areometers, to indicate in a constant and uniform manner the point of concentration. Each evaporating boiler should have a wooden or earthern vessel to receive the skimmings, which are removed during the process of concentration.

§ 3. *Process of Concentration.*

The apparatus for this purpose, it has already been stated, should be so placed that the clear juice from the defecation boiler should be delivered to it by a natural declivity, with a view to economy of labor.

The process of concentration is extremely simple, except, perhaps, in the evaporating battery, (*batterie evaporatoire*) which will be described by and by; in the meantime there are some particulars relating to the management of the syrup common to all methods, and these are as follow :—

When the juice leaves the defecating for the concentrating boiler, it generally froths a good deal; but this froth is often occasioned simply by the fall of the juice in the air. However, if this froth, instead of subsiding immediately, have a sort of consistence—if fat and greasy to the touch, it would be a certain proof that the juice had been badly defecated. In the defecation boiler, the juice often falls, when left to settle, from a temperature of 80° Reaumur (212° Fahrenheit) to 50 or 60° R. (145 or 167° F.,) especially when a large quantity is operated upon. It will be well therefore to prolong this period of settlement for two hours. The juice in that case will never enter the concentration boiler in a state of ebullition, and before boiling, it is covered with a white scum, the formation of which it is advisable to encourage by not forcing the fire too much at the outset. This scum is composed of albuminous matter, which, coagulating, thus envelopes all the particles held in solution in the liquid, and carries them to the surface with it. It is generally white, but grey when the juice has not run perfectly clear, a circumstance that now and then will occur, even with the most experienced hands. In this case a little blood, or white of egg, is sometimes applied with effect to the juice. The scum will then rise more abundantly; but care must be taken so to manage the fire as that the boiling shall only be visible on a point of the surface, and that very gently, otherwise the scum will mix again with the liquid, and in that case can only be got rid of by filtration or precipitation, both of which, on every account, ought to be sed-

ulously avoided; but when all the scum is removed the fire may be forced, and concentration will proceed rapidly.

During the evaporation it always happens that the juice has at certain times a great propensity to rise in the boiler. This disposition will be the greater when the juice is not of the best quality, or has not been well defecated. However, all juice is more or less subject to it. This rising is occasioned by a number of bubbles, formed by the disengagement of the steam, and the resistance offered to it by the viscous nature of the juice. These bubbles rapidly succeed each other, and form such a head, that they would soon overflow the boiler, unless means were taken to prevent it. The simplest, is to throw in any fat substance, as oil, suet, or butter, the last generally preferred, which soon disperses the bubbles. It is sometimes necessary to repeat this operation several times during the process of concentration.

To ascertain the period when the juice has arrived at a proper degree of concentration, and when evaporation ought to cease, the areometer must be made use of. These are the general features of this operation, by whatever process it is accomplished. A few particulars follow, of details peculiar to different systems and apparatus.

1. *The Customary Method of Concentration.*

Care having been taken to obtain the juice clear from the defecation boiler, and proper attention paid to skimming the liquor, management of the fire, &c., as has been described, the suitable point at which clarification should begin ought to be particularly attended to. This, according to the rule generally adopted, is at 26° of Beaumé, boiling, or 30o cold.

2. *Process by the Evaporating Battery, (batterie evaporatoire.)*

The battery consists of seven boilers, all of the same size, four boilers forming the first surface, No. 1, two on the second line placed below the first, so situated as to receive their charge by the simple movement of the rope and pulley. They are called No. 2; then a little lower stands No. 3, or the clarifying boiler, for it also serves for this purpose.

In beginning to work, the four boilers (No. 1) are first charged with the juice furnished by the defecation. Each of them should have 28½ gallons (125 litres) making 114 gallons (500 litres) for the four, and which absorb the juice furnished by one defecation boiler. The fire is then lighted, the albumen added, if necessary, and the surface skimmed. While these four boilers are in a state of ebullition, the two boilers, No. 2, are charged with water, in order that fire may be ready in the furnace, and when the boilers, No. 1, have undergone their half-hour's ebullition, the water is discharged from those of No. 2 into No. 3, and they are charged with the juice of No. 1, which latter are instantly filled with a fresh charge from the defecating boiler. Fire is then put under No. 3, and half an hour after the operation about to be explained, No. 3 is emptied of the water it contained, and into it is poured the syrup from the two boilers, No. 2. These again will in their turn be recharged with syrup from the boilers, No. 1, which latter will have a new charge, and so on continually. These operations of charging and emptying ought to be performed regularly every half hour, if the evaporating surfaces of the different boilers be rightly calculated; but if anything should occur to prolong the operation, (from half an hour to three quarters for example,) it would not affect the general result, such is the advantage of the harmony in the arrangement above recommended.

In this evaporating battery, the scum should be carefully removed during the process of evaporation, and this is easily managed, owing to the comparative smallness of the dimensions of the boilers. Should the charging and discharging take place every half hour, one may calculate on working off in 15 or 16 hours 12,000 litres (upwards of 3,000 gallons) of juice. But if the work go on night and day, 24,000 litres (more than 6000 gallons) may be calculated on as the result. Again, supposing that the year's work last 4 months, or 120 days, and that 70 per cent of juice was extracted, it would require, to maintain a similar manufactory, about two millions of kilogrammes (1970 tons) in the first case, and double that quantity in the second.

If the smallness of the apparatus be considered in reference to the magnitude of the labor performed, it will exhibit a striking example of the advantages of a *continued* work, which certainly allows of greater results than can be obtained by any other method.

It may be objected on this point, that the apparatus which has been described is fitted only to a large undertaking, and would not do for instance for a small building where not more than a million of kilogrammes (985 tons) are required to be worked up in four months; this is true enough, but the system is not less applicable to this last case. It is only necessary to diminish the number of the utensils. Thus, instead of four pans, No. 1, use two, and so on in proportion, by which about half the quantity can be obtained that has been stated in the first instance, and this may accord very well with a small establishment. In fact there are many of these which do not work above 5 or 6000 litres, (1150 or 1500 tons.) Below this it could not well be reduced, because then the pan No. 3 would be too small to be used with effect, and would render the clarification very tedious and difficult.

CHAP. VII.

Of the Clarification of the Syrup.

Clarification is intended to separate the juice concentrated nearly to 30° from the substances which it holds in suspension, and to carry off by certain agents the coloring and other extraneous matters formed during the concentration process, and which would otherwise affect the quality of the sugar. Clarification is obviously then an important part of the process of sugar making, and may be divided into two distinct operations, the one chemical, whose object is effected by clarifying agents, such as animal charcoal, albumen, &c., and the other, mechanical, intended to separate from the syrup the carbon and the solid substances collected by the albumen. This last operation, which may be performed by precipitation, or better still perhaps by filtration, will, from its importance, form the subject of a particular chapter. It will be distinguished from clarification, properly so called, which term will be applied solely to the

chemical operation. It is this latter which is treated of in the present chapter, and it will be well to note, that every time clarification has been, or may afterwards be spoken of, it is this, and not the mechanical operation that is alluded to.

§ 1. *Clarifier.*

In manufactories where two concentrating boilers do the work of one of defecation, one of these acts as a clarifying pan or boiler; and with this view, when the concentration is arrived at the required areometrical density, one of these boilers is emptied into the other. All the syrup is thus brought together, and the clarification is proceeded with.

In the *batterie evaporatoire*, before mentioned, No. 3 forms the clarifying pan.

The utensils used in the clarification are:—1. An areometer; 2. A skimmer; 3. A stirrer; 4. A wooden cup for the animal charcoal: 5. Another cup to dilute the bullocks' blood, or the milk.

§ 2. *Clarifying Agents.*

Of these, animal charcoal and albumen or curdling matter are decidedly the best and most effectual, as well as the simplest.

1. *Charcoal.*

M. Derosne was the first who applied animal charcoal to the refining of sugar. It possesses a discoloring property very far superior to that possessed by vegetable charcoal, but its operation is not confined to this object merely, but to react on the extraneous substances remaining in the syrup, and to promote its crystallization. The quantity of sugar is materially increased by its use.

2. *Albuminous Matters.*

Albumen is one of the most prevalent substances in the animal organization, constituting nearly the whole of the solid matter of the white of an egg, and is found in blood in large quantities.

Alcohol, acids, and heat, have the property of precipitating albumen. It coagulates in lumps, which float in the liquor, and may be easily separated by precipitation or filtration. It is this property that has made it so desirable for refining, and particularly the beet-root sugar. Here it is only coagulated by heat, after being dissolved and distributed through the mass about to be clarified, carrying with it all the impurities therein contained.

1. *Whites of Eggs.*

These contain the largest quantity of albumen of any other substance, and accordingly would be the best agent of clarification, but for their great expense as compared with blood. The proportion is as five eggs to a litre ($1\frac{9}{11}$ pint) of blood. They must be well beat up, and mixed with water at the rate of four pints to five eggs.

2. *Blood.*

Blood, when it first issues from the veins of the animal, contains, besides albumen, a sort of fibrous matter, which must be separated, otherwise the blood will become clotted and unfit for the purpose of clarification. To prevent this, the blood, when collected, should be beaten up with a sort of rod; the fibrous substance will soon separate in the form of long filaments, which may easily be got out by passing it through a hair sieve. The blood, thus separated from the fibre, may be preserved in a liquid state to an indefinite length of time, and this precaution is the more necessary, as it is often advisable to provide it beforehand for ten or fifteen days.

The best blood for clarification is that of bullocks; next, that of cows, sheep, and calves: pigs' blood is always rejected as bad. Before applying the blood it should be mixed with about two parts of water.

3. *Milk.*

The milk employed for clarification should be skimmed. This agent is certainly a very convenient one for agricultural establishments, not only from its cheapness, but because it is always at hand.

§ 3. *Operation of Clarifying.*

The quantity supposed to be operated on is 500 litres (114 gallons) of juice, that is to say, 82 litres ($18\frac{1}{2}$ gallons) at 26° boiling, which corresponds to 30° cold. When it is ascertained that the right proportions of lime and acid have been added to the syrup, the animal charcoal may be applied: of this, about half a pound may be reckoned to each gallon. It is then put into the boiler, the syrup being at the time in a state of ebullition, stirred, and skimmed well. The black substances thus taken off are braided together and mixed with the liquid. When the carbon is well incorporated with the mass, it is left to boil for some minutes. Take care to examine, lest the black lumps are not precipated to the bottom of the boiler. The charge above recommended is a medium one, but, for a general rule, the better the syrup, the less carbon, and *vice versa*.

In this stage of the process, the syrup appears black and muddy. On examination, the juice is anything but clear, or likely to be so; and in this state it is, that white of eggs, blood, or milk, are applied to such advantage.

Whilst the black is thus operating in the boiler, let 8 decilitres of blood (about $1\frac{1}{3}$ pint) be prepared, and mixed with water, or four eggs, or one litre six decilitres (rather more than $2\frac{1}{2}$ pints) of skimmed milk, being after the rate of one litre (not quite two pints) of blood, two litres ($3\frac{3}{4}$ pints nearly) of milk, or five eggs, for one hectolitre ($22\frac{1}{2}$ gallons of syrup. One of these ingredients is then put into the boiler, stirring the whole up briskly, and after boiling for a short time, the syrup is thus prepared for cleansing:—

The juice is examined in a spoon, and if the clarification be good, the syrup exhibits flakes which are easily precipitated, leaving a clear limpid juice. If this is not the case, the quantity of albumen is not sufficient, and the filtration will not be complete.

In this case, it will be requisite to add a fresh dose of eggs, blood, or milk, until the liquor be no longer found dark and muddy.

The refiners generally prefer old to fresh blood, and though even offensive to the smell, it does not in the least affect the quality of the syrup.

CHAP. VIII.

Filtration.

A mode adopted in some manufactures. Instead of clarifying the syrup at 30° of concentration, this process takes place at a much less density, say 20°, after which the syrup is put into cisterns, or else left to settle in the boiler. In order

that this may be done effectively, it is obvious that the juice should not be very thick, for it is indispensable that the operation should go on as briskly as possible.

Filters are of various descriptions and sizes, according to the magnitude of the work to be done by them. For the most part they are composed of flannel.

In adopting the *batterie evaporatoire*, already described, and which yields 18½ gallons of evaporated syrup, the filters should be equal in capacity to one hectolitre, (3½ English cubic feet,) or even two, without inconvenience; and, indeed, this last size is to be preferred, as it admits of a double charge, and consequently, a greater facility of filtration.

We shall then suppose a deal vessel, of a cubic form, firmly put together, to which we shall give for the inner side, six decimetres, nearly two feet. This cube will be open on the upper side, except when covered by a lid. The inside of the vessel should be lined with thin copper. At the bottom is fixed a cock to collect the liquor furnished by the filter. In this cube is placed a wicker trellis, exactly fitted to it; and having, like it, five surfaces only. In this wicker frame is placed a flannel, the upper edge of which should be secured by a border of strong canvass.

Under the cock of this filter is placed a bascule, intended to separate the thick from the clear liquor, which should be carried to a common receiver.

A filter of this kind will be able to carry two, or even three successive charges of 18½ gallons, but not beyond this, without impeding the operation of filtering. Two charges will pass in about three hours, if the clarification has been good. At this rate, about eight filters will be found amply sufficient for the scale above mentioned. These eight filters should be arranged in one line, or at most in two. Their cocks should be placed over a copper pipe or trough destined to convey the clear juice into the reservoir.

It will be as well to provide plenty of these flannel linings; say one for each charge.

§ *Appendages to the Filters.*

These are, 1. The bascule, or moveable spout, to draw the liquor clear, with the cock on a larger scale. This is intended to change suddenly the direction of the syrup, which appears black when the cock is first opened. The liquor can be conveyed into the moveable boiler, (of which more will be said hereafter,) or into the clear syrup pipe. Each filter cock ought to be provided with a suitable bascule, which is easily moveable.

2. The clear syrup drain should be of semi-circular form, and of copper, or wood lined with copper. It serves to receive the clear syrup, by means of the bascule, and to convey it into the reservoir. It is connected with all the filters, and of course should have a slight fall towards the reservoir.

3. The black syrup cistern ought to be of copper. It receives the syrup which flows from the filters when the cock is opened. This is always more or less discolored when first set running; and ought to be collected by itself till it runs clear.

4. The reservoir intended to receive the clear syrup should be of copper, and of a circular form like a boiler. It should have a small well-hole at bottom, that all the liquor may be drawn off by a pump if necessary. It ought to have a cover. As to its size, it should be large enough to contain all the syrup clarified in a day. Thus, with the evaporating battery, 12 hours work will yield 450 gallons of clarified syrup. The reservoir, then, ought to contain this quantity. If, on the contrary, with this same battery, the work is continued day and night, one-third of the above size will be sufficient.

§ 3. *Operation of Filtering.*

The charge being put into the filter, the bascule should be turned. The cistern of black syrup is then placed over the spout, and the cock is opened full. The syrup at first runs thick; after the first flow, the cock is half shut, and it is left to run till the liquor is quite clear. When at this point, the bascule is lowered, without touching the cock, and the syrup is conveyed by means of the channel into the reservoirs.

A second charge is then laid to the filter, and, in some cases, even a third, in succession; but this is not advisable, on account of the time the last charge requires to drain through, owing to the previous depositions. When no more liquid can be obtained from the rough juice, (if one may so call it,) the strainer and its contents are removed, and the latter is thrown into the defecation boiler. A little water is passed through the filter, if necessary, and a new strainer applied.

CHAP. IX.

Boiling the Syrup.

The syrup, in the state in which it is furnished by the filter, at 30° cold, is not sufficiently concentrated to crystallize; and the object of boiling is, to carry off the superabundant water which it may yet contain, and thus prepare the syrup for crystallizing as it cools.

This boiling is but the end and object of the concentration process; and the most convenient utensil for this latter operation is also the best adapted for that of boiling.

The fire must not be forced too briskly, or the syrup will be liable to burn; consequently the evaporation will be slow, compared with that obtained during concentration.

§ 1. *Boilers.*

Two pans or boilers are necessary, each containing 66 square decimetres (1023 square inches) of surface at bottom, about 3 feet in diameter, and 10 inches in height. They will be thus capable of receiving together, every half hour, 82 litres (18⅓ gallons) of syrup.

These boiling pans should be of solid copper, and the bottom, which is constantly exposed to the fire, thicker than the sides.

§ 2. *Appendages to the Boiling Pan.*

These are, 1. A vessel for the skimmings. 2. A skimmer. 3. A thermometer.

§ 3. *Of the different methods of taking Proof.*

These are, technically, first, by the *thread*; second, by the *breath*; and third, by the *thermometer*. The first is managed by taking a small portion of

the syrup (when not too hot) between two fingers; being at that time in a viscous state, a thread is formed by the gradual separation of the fingers, and it is the strength of this thread that indicates such a state of concentration as is required for a good crystallization; but if, when the fingers are separated, the thread is weak, and snaps off immediately, the concentration is not perfect, and the syrup will not crystallize. The following method is preferred by some.

2. *By the Breath.*

This is managed by the aid of the skimmer, which is plunged into the boiling syrup, stirred a little, and then withdrawn quickly; then bringing the skimmer within a few inches of the mouth, it is blown upon strongly, all over the surface. If the syrup is arrived at the point of crystallization, a number of bubbles will escape from each of the holes of the skimmer, and become inflated like so many little balloons, but bursting almost instantly. The number of these bubbles, and the time they remain without breaking, indicate the gradations between a strong and a weak boiling. They are seldom or ever formed but in a state of the syrup necessary to a good crystallization.

This mode of proof, as in the former case, is founded on the viscous nature of the syrup. A little practice will soon explain the manner of performing the operation, and its utility.

3. *Proof by the Thermometer.*

When the thermometer is plunged in the boiling syrup, it ought to indicate 90° R. (234 F.), to constitute what the French call *une cuite convenable*, a suitable boiling point. If short of this, the boiling is reckoned weak. On the whole, therefore, the thermometer may be considered a safe guide. In fact, when the syrup, at 30 (areom.) begins to boil, the thermometer stands at only 81° R. (214 F.), but gradually rises to 90° R. At first, the fire may be forced pretty strongly, but when the syrup is at 85° or 86° of temperature, it is necessary to check it, because it is then more liable to burn.

§ 4. *Operation of Boiling.*

When the clear syrup is collected in the reservoir in sufficient quantity for boiling, which, in a continued work, may be about 200 or 300 litres (45 or 67 gallons), this operation is proceeded with. The boiling pans are charged with 41 litres (9 gallons) of syrup each. The fire is then applied to the furnace, and the thermometer suspended. The syrup is soon in a state of ebullition; for it is nearly at the boiling point from the filters.

If, by any chance, the syrup in the reservoir should be at all troubled, the white of an egg may be applied to each charge of the pan, and then carefully skimmed.

When the syrup is good, it gives out, after having thrown up its first scum, a white pearly froth, which covers the surface, and ought to remain all the time of boiling, only that it should turn brown towards the end. There are always, during the boiling, some moments in which the syrup rises, and threatens to overflow the pan. To hinder this, small lumps of butter are occasionally put into the syrup.

The workman who is charged with the management of the fires ought to watch the thermometer, as the period for proving the syrup advances.—When, for instance, it is at 89°, proof should be taken. At 89½° or 90° it is time to discharge the pan. The proof point of molasses, when reboiled, is generally 91° or 92° R.

When the boiling is finished, the pan should be discharged. This may be done immediately into the cooler (*rafraîchissoir*), or into some intermediate vessel adequate to receive such a charge.

Two charges of 41 litres (9 gallons) each, will give about 11 gallons of boiled syrup.

CHAP. X.

Cooling of the Boiled Syrup.

When poured out of the boiling pan, the syrup is put into a vessel capable of holding all the boilings furnished during 10 or 12 hours. In its progress thither, the syrup undergoes two movements, and two airings, by the mere pouring from the pan into an intermediate vessel, then from this latter into the cooler.

When the syrup is thus got together in the cooler, it remains there 10 or 12 hours before it is run into moulds. It ought to fall during this time to 65° or 70° R. (180 to 190 F). It then is time to run it into moulds. If the syrup is good, one ought to find many crystals at the sides and bottom of the cooler. These crystals, distributed throughout the liquid mass, are carried into the moulds, and the syrup thus undergoes a new airing and a new movement, which assist the crystallization.

It is necessary to be careful not to suffer the syrup to be carried at too low a temperature into the moulds.

§ 1. *Cooler and its appendages.*

The cooling pan (*rafraîchissoir*), is a sort of moveable copper, only that instead of heating, it serves to cool the syrup. There is, of course, no fire-place attached. It ought to be of solid copper, round, and rather wider than it is high. The size ought to be proportioned to the quantity of syrup that can be boiled in 12 hours' work. With the evaporating battery of seven boilers and two bascules, one should be able, in 12 hours, to obtain 1176 litres (265 gallons) of boiled syrup, and with the small battery, in the same time, 132 gallons. In the first case, therefore, the cooling pan should be capable of containing 14 or 1500 litres (340 gallons or so), and in the second half that quantity, or 170 gallons.

	Diameter.	Height.
The former - - -	59 inches - - -	35 inches.
The latter - - -	47 do - - -	27½ do.

It will be well to have two or three of these pans.

A sort of spatula [of iron] is used with the above, which serves to detach the grain. It should be about 4 feet long. Also, two filling pans or basins. These basins are of copper. There ought to be a ladle or spoon, [also of copper,] and a thermometer to each pan.

§ 2. *Operation of the Cooler.*

When the first boiling is discharged, it would very soon cool were not a second soon added, a third, and so on, in succession. When two boilers are used, the charges are supposed to come every

quarter of an hour, whereas if only one is used, the interval between these will be half an hour.—Experience has shown that the most suitable temperature for filling the pans is from 60° to 70° R. [167 to 190 F]. The boiled syrup should remain 10 or 12 hours in the pan, provided that the temperature does not fall below 60°; to prevent which, it may be advisable, besides a lid, to cover the sides with flannel, which preserves it from contact with the air. In case these precautions should fail of preventing the pan from cooling too fast, it can be charged every 6 or 8 hours; by which means, though it would not be full, yet this is a matter of no great consequence. In any case, it will be advisable, every four or five charges, to stir up the mass with the iron spatula.

CHAP. XI.

Filling the Moulds.

The operation of filling the moulds consists in pouring the syrup into certain vessels, where it is intended to crystallize. This immediately follows that of the cooling pan *(rafraîchissoir);* but before we proceed to filling them, it may be as well to say something of the moulds themselves.

§ 1. *Moulds.*

These are principally of common earthenware. Those most commonly in use for beet-root sugar are of the largest size, and are known by the name of *bastards*. They will hold from 10 to 12 gallons each. They are cone-shaped, and have a hole at the bottom of them. Each mould should have a pot, made of burned clay, placed underneath the point of the cone, [as will be hereafter explained,] to receive the molasses which drains from it.

A mould of this kind, full of well-boiled syrup, will purge itself of molasses in a month. Thus the number of moulds requisite for a work of any given size, may be easily ascertained. For instance, in such an one as has been imagined, in which 24,000 litres [6000 gallons] of juice are produced daily, yielding 2370 litres [610 gallons] of syrup, it would be requisite to have 48 moulds for each day; or, as each mould requires 30 days to clear itself, it will be necessary to have $48 \times 30 = 1440$ moulds, and as many pots or receivers, for a manufactory capable of working off 4000 tons in 4 months. Each mould thus serves four times in the season; but perhaps the safer way will be, to have about 1800, to provide against contingencies. In many beet-root sugar manufactories they make use of large oaken moulds, well-hooped, containing 200 litres [45 gallons]; but care must be taken to keep the hoops tight, lest the syrup should escape at the joints. However, it is next to impossible entirely to prevent this, and therefore this kind of mould is not to be recommended.

§ 2. *Operation of filling the Moulds.*

When a pan containing 1185 litres [305 gallons] of syrup has been poured into the moulds, it will be necessary to prepare a number of moulds corresponding to this quantity;—which will be 24, each containing 12 gallons. Eight or ten hours before filling, these 24 moulds should be laid in water, for which purpose a large wooden cistern *(bac a formes)* is provided in a convenient situation.

These moulds have all a hole at the bottom, through which the molasses drains; but as they are to be filled with sugar in a liquid state, this hole is temporarily stopped up, either with clay or a cork.

When they are all corked, the workmen proceeds to the planting (*plantage*) of them, which means the setting them on end ready to fill, and this usually occupies two rows.

A workman then, by means of the iron spatula, detaches the grain which adheres to the bottom of the cooling pan, and continues stirring the contents till the pan is emptied.

A second workman then takes a sort of basin suited to the purpose, called a filling-out basin, (*bassin d'empli*) which is filled by a third man, by means of the ladle, with syrup from the pan to within a few quarts of its capacity. It is then poured from the basin into the moulds, taking care not to give it all to one, but to divide the charge between two or three moulds. After this, a similar quantity is poured into other two or three moulds, and so on till the whole 24 have received nearly an equal quantity. This is called a *round.* When one round is finished, another is begun in the same manner, till the moulds are full; and this ought to complete the discharge of the cooler. To expedite the work, two men should be employed at the basins; whilst one is filling the moulds, the other may be charging the basin at the pan. Whilst filling, a moderate temperature ought to be kept up; say 15 to 20° R. (67 to 77 F).

In a general way, the syrup, in a few hours after the moulds are filled, is covered by a crystalline crust, if of good quality, but with a mere skin if not so rich. In every case, the sugar ought to begin to crystallize at the bottom and sides of the mould, layer on layer; so that in 24 hours after filling, all the crystallizable matter, which ought to form in this first operation, is nearly precipitated. During this time, the sugar cools, a contraction takes place in the mass, and if the moulds have been filled at a suitable temperature, this contraction manifests itself at the surface by a slight depression towards the middle. This bespeaks a good boiling (*bonne cuite*), and a good filling (*bon empli*).

CHAP. XII.

On conveying the Moulds to the Refineries, (Purgeries,) and Purifying the Brown Sugar.

The moulds, after cooling, contain crystallizable matter saturated with a mother liquor or syrup, which must be got rid of. To this end, 36 or 40 hours after the filling out, and when the temperature has fallen to about 20° R. (77 F.) they are taken into the refinery No. 1, where they undergo the first purgation. There the corks or other stoppers are taken out of the bottoms of the moulds, and each mould is placed on its receiver in a vertical position. The moulds, as soon as they are unstopped, give out molasses, which runs into the receivers below, and as this at first is a tolerably rapid operation, the pots should be carefully watched, in order to change them when full. They are emptied into a cistern capable of holding a large quantity.

These moulds ought to remain a fortnight in the refinery No. 1, where the temperature should only be 12 to 15° R. [60 to 66 F]. There they give out full two-thirds of their molasses. Both the

refineries [No. 1, and No. 2,] ought to be situated at a convenient distance from the filling place, and, if possible, adjoining each other.

No. 1, which is only at a temperature of 12 to 15° R., has not the power to separate the sugar from all the molasses which it contains, because, to do this a higher temperature is necessary to liquefy the molasses, and make it flow more readily.

For this purpose, the moulds, after 15 days' running, in No. 1, are removed into the refinery No. 2. where a temperature of 40 or 50° R. [122 to 145 F.] is kept up. There, they are placed evenly on the pots; but before this, to facilitate the flow of the molasses, it is advisable to run an iron bit into the opening at the bottom of the mould, in order to make a circular hole in the cone of sugar.

The moulds remain for a fortnight in the refinery No. 2, after which time, they will be well purged, and the brown sugar may then be separated.

If, whilst changing the pots, it is observed that a mould does not run, and that from its weight, &c., there is reason to suspect it is stopped up, it should be re-opened with the iron bit. This is often necessary.

To expedite the emptying of the pots in the molasses cistern, they are arranged in some place adjoining, and in each refinery is a sort of tunnel furnished with a long pipe which carries the molasses into the great cistern or reservoir. This is very convenient, and saves much hand labor.

The process of claying sugars is not described here, but the author is of opinion that the brown beet-root sugar may be clayed to advantage, and he has no doubt that in point of quality it may vie with fine Havannah sugar, so much esteemed by refiners.

CHAP. XIII.

Emptying the Moulds, and collecting the Brown Sugar.

When the moulds are thoroughly purged, which is easily ascertained by their weight, and by the quantity of syrup which they have furnished, it is necessary, in order to obtain the brown sugar, to empty them *(les locher)*.

This operation consists in placing the cones, or moulds on their bases, in which position they are left for an hour or two, then lifted up and down, striking them smartly against the floor. These shocks eventually separate the mass of sugar from the mould, and it comes out in the form of a loaf.

The loaf being thus detached from the mould, the latter is taken away, and the loaf left uncovered. If it come out whole, it is of a conical form, of which the color, more or less light, is always different from the base to the head. The finest and dryest sugar is at the base or widest part of the cone. The point is generally moist.

When the moulds are thus emptied (*lochées*) the syrupy heads are cut off, and put into one of the moulds, because if they are mixed with the loaves in general, they would alter their quality, and might impart to them a moisture which would be very hurtful.

It sometimes happens that the loaf instead of coming out of the mould whole, tumbles into pieces; in which case, it must be knocked till no more sugar can be obtained; but this is rarely the case if care be taken to cut round the edges of the loaf with a knife.

The syrupy heads, collected in the moulds, may be put to purify in the refinery No. 2, and after a long time they will yield an ordinary brown sugar. The author thinks that the best way is to return them to the syrup for clarification.

The loaves, and all the brown sugar taken from the moulds, are then put into the store or warehouse, from whence they are taken to market, or to the boiler, if refined on the premises.

If the brown sugar proceeds from juice defecated with lime alone, it will be good enough of itself, but the molasses will have a disagreeable flavor and smell, and cannot on that account be reboiled; but this is not the case where sulphuric acid has been employed.

In general, there is a difference between the beet-root sugar manufactured at the beginning, and that made at the end of a season. This, as has been stated, proceeds from the inevitable alteration which the root undergoes during its preservation. It is no uncommon thing to see the roots worked immediately after harvest, yielding a strong, clear, well crystallized sugar, whilst at the end of the year the same roots will yield only a brown, weak, and pasty sugar.

With all this gradation of quality, the beet-root sugar is always preferred for refining, to the brown sugar of the Antilles, and affords a greater profit to the refiner. It appears that the refiners are beginning to find this out, for it is much in demand in the markets.

On the hypothesis of a daily manufacture of 2370 litres (610 gallons) of boiled syrup, from 24.000 litres (say 6000 gallons) of juice, at 70° R. (190 F.) represent the daily produce of 34,285 kilogrammes (33¾ tons) of roots, the sugar may be extracted at the rate of 3½ or 4 per cent—if we say, 3½ per cent, there will be made 1200 kilogrammes (2⅕ tons) of brown sugar daily, without reckoning molasses: of these, more in the next chapter.

CHAP. XIV.

Re-boiling the Molasses.

In most manufactories the molasses are not boiled till the season for sugar-making is over, or nearly so; therefore, very large cisterns are wanted in which to store them. They should be kept in vaults, rather than in the warehouse, at the temperature of 10° R. (55 F). These reservoirs should be of wood, lined with copper, or lead; or they are sometimes of tarras, or Roman cement.

It appears from calculations not necessary here to particularize, that the daily quantity of 24,000 litres (5120 gallons) of juice produces in 120 days, 149,000 litres (33,663 gallons) of molasses, from which data are ascertained the size of the reservoirs to be as follows:—If ten are employed, they will each require to contain 15 cube metres (525 cubic feet)—if only one, nearly 150 cube metres (5250 cubic feet).

As these reservoirs cost a good deal, it will be for the manufacturer to determine whether he will not work up the molasses as he proceeds with his sugar-making; which is now done in the best manufactories. Each method has its advantages and disadvantages. In the first, large reservoirs must be erected, and the syrup, having to be kept for 3 or 4 months, is exposed to changes which

may render the subsequent operations difficult, without clarification and filtration, especially in a bad season. In the second, an additional number of copper boilers, of cooling apparatus, of moulds, &c., are required; but the molasses being close worked up, is less liable to change, and works readily without clarification or filtration.

The author however gives the preference to the large reservoirs, and to wait till the rest of the work is done, before they are reboiled. It is on the whole the least expensive plan, and instead of requiring an additional number of hands as the other would do, requiries only the same, to be kept on two or three months longer.

CHAP. XV.

Is occupied by a description of Achard's method of crystallizing by steam, as successfully practised by M. Crespel, who in that year (1835) we learn, had worked up 5,000,000 litres (about 2450 tons); but as various improvements have been made on this plan since that period, it is perhaps unnecessary to detail the method here described. There can be no doubt, however, of the excellence of the principle, and we may say further, that the perfection which the manufactory of beet-root sugar has attained in France at this day, is mainly attributable to the application of steam, as an agent both of crystallization and evaporation.

CHAP. XVI.

Use of the Pulp for feeding Cattle.

It has long been ascertained that the beet-root is an excellent article for fattening cattle, and consequently, there are few agricultural districts in which it is not cultivated more or less extensively, for this purpose.

The manufacture of beet-root sugar, besides its advantages in a commercial point of view, presents this important one to the agriculturist, that it takes from the beet-roots only a part of their nutritive matter, at the same time that it furnishes for three or four months of the dead season, a moist food, capable both of fattening beasts, and of keeping cows in milk.

An ox consumes daily about 25 kilogrammes (55lbs.) of pulp, and a sheep 5 k. [11lbs.] It is advisable to add to this about 2lbs. of linseed cake per day. A ton of pulp will thus last 40 days, during which time ¾ cwt. of linseed cake will be consumed. The beast both takes it better, and thrives faster for it.

An idea has been started that the pulp may be rendered more nutritive by boiling, which it is said can be readily accomplished by steam. The success of this plan must however depend greatly on the price of fuel; though we are quite ready to admit that it is not so extensively practised by farmers as it might be: where, however, there is a steam apparatus for other purposes, on the premises, it can be managed with very little difficulty,—a large tub, close covered, with a pipe leading from the steam boiler, being all that is necessary for common agricultural purposes.

In estimating the juice extracted from the beet-root at 70 per cent, 1000 kilogrammes [say 1 ton] of root will yield 30 per cent of pulp, or 300 kilogrammes [6 cwt.] Thus a manufactory which works 34,000 kilogrammes [34 tons] daily, will produce 10,200 kilogrammes [10 tons] of pulp.

Pigs are said to be very fond of the pulp of the beet-root. The time and season usually allotted to sugar-making, accord very well with the fattening of cattle; for beasts bought in lean at the beginning of the season, [the end of autumn,] may be returned by the month of February.

If the manufacturer does not wish to keep cattle, he can always dispose of the pulp to the neighboring farmers.

M. Crespel is stated to have sold his at 15 francs 12*s*. 6*d*.] the 100 kilogrammes [2 cwt.,] and says that what he used himself paid him 24 fr. [20*s*.] the 100 kilogrammes; but taking it at 12*s*. 6*d*.. a manufactory which works up 34 tons of root daily, will turn out pulp to the amount of 153 fr. [£6 7*s*. 6*d*.) in the same time.

The pulp will keep very well for two or three months, if deposited in holes, closely packed, in the same manner as brewers' grains are preserved in some places. They both acquire a sourish taste, which does not seem at all unpleasant, nor unwholesome to cattle.

CHAP. XVII.

Of the Requisite Buildings.

A building suitable for the manufacture of beet-root sugar should contain—horse-works, equal to four horses; a rasp house and press room; a pan and filter room; a room for filling the moulds; a molasses store; two purgeries, No. 1 and No. 2; a brown sugar extracting room; a brown sugar store; a molasses distillery; a beet-root store; a place for cleaning the roots; a stable; and sheds for the fatting of beasts

The reservoir in the molasses store should be below the level of the ground, that a floor may be thrown over it, on which the syrup may be deposited in hogsheads; so that in case of any leakage from them, the syrup will naturally flow into the reservoir below, for which purpose the floor should have a slight inclination towards one of its corners.

Purgery No. 1 is intended to receive the moulds during the first fortnight of their purging, and should be large enough to hold 8 or 900 moulds. An air stove should be placed in the middle of this room to maintain a temperature of 66° to 77° Fahrenheit.

In purgery No. 2 the moulds, after remaining for 15 days in No. 1, finish purging themselves; and here also they finally remain. This room should be large enough to contain 11 or 1200 moulds. A high temperature should be kept up here, say 40° to 45° Reaumur, [120 to 133 Fahrenheit,] in order to separate the brown sugar from the molasses, which can only be done thoroughly by means of a strong heat; for which purpose two stoves will be required.

After the moulds are purged of their molasses, they are taken to the sugar extracting room, emptied, and then disposed in piles.

CHAP. XVIII.

Question of Economy.

We have seen exhibited in the early part of this article, the average rate at which the beet-root is furnished to several large establishments. The price will appear high to the English farmer, but he will please to remember that one cause of such high price is the very light crops the French farm-

ers are in the habit of growing. Were the crops heavier, I have no doubt the price would be lower; because, if 10s. per ton would pay the grower in England, [as I believe it would,] it certainly ought to pay in France, where the expenses of every sort are much lighter; and if it does not pay, it is not owing to the low price so much as to want of skill in the grower; not that I would advise the going into the opposite extreme, of forcing a crop by heavy manuring. A root may in garden culture be forced to an extraordinary size and weight, but of what does this weight consist? Of a great deal of watery matter, worse than useless for sugar-making, inasmuch as it displaces the saccharine juice so abundant in roots of smaller size. No where perhaps is beet raised of such vast weight as in the neighborhood of London. I last year weighed two or three roots, in company with my friend Mr. Philip Taylor, which, if I recollect right, varied from 35 to 38 lbs. each root. The produce of an acre at this rate is enormous; and yet no man would say that roots like these, are the better for the purposes of sugar-making: certainly not; nay I very much question whether the proportion of saccharine matter in them, would pay for the labor of rasping, boiling, &c., to get at it. It is this propensity of the farmer to force his crops to the utmost, especially in the neighborhood of large towns, that tends to thwart the views of the manufacturer. His interest and the farmer's are, as we have said, diametrically opposed, if the one buys and the other sells by *weight;* perhaps a better way would be that adopted by some of buying by *number*, the manufacturer taking only such sized roots as he likes. In this case, there is no inducement on the part of the farmer to manure over highly, because all the largest roots would either be rejected by the manufacturer, or if taken, would be worth no more to the grower than if of half, or probably one third the size. But to the question of profit and loss.

M. Chaptal calculates that to fit up an establishment capable of manufacturing 10,000 lbs. of beet-roots a day, would cost 20,000 francs [£833 6s. 8d.]; but he reduces this expense to 16,000 [£666 13s. 4d.], if there is a convenient water-course, and a good wine-press on the premises. He reckons the expenses of such an establishment for each day, for roots, [say 12,000 lbs. in order to have 10,000 always ready for the rasp], cleaning and other hand labor, horse work, animal charcoal and fuel at £8, or for the season of 120 days, £960. The charges for refining the sugar are added to, and are totally independent of, the above, but as this is a distinct branch of business, and one by no means advisable for sugar makers in common to enter into, I purposely omit them. Produce of the above 10,000 pounds of root, 210 kilogrammes [4 cwt. 14lbs.] of brown sugar, worth at market £12 5s.

M. Matthieu de Dombasle has a manufactory calculated to work up 4,500,000 tons in 150 days.

The first cost of buildings, machinery and utensils [in which are included those necessary for refining] 70,000 francs, or -	£2916 13 4

The produce and expenses of this establishment are not stated here, because they are so mixed up with refined sugar, with which we have nothing now to do, that they cannot well be separated. It may however be observed, that M. de Dombasle reckons on obtaining 4 per cent of brown sugar, whereas M. Chaptal only admits 3 per cent.

M. Crespel—Expenses on 1000 kilogrammes [2209 lbs.] Roots [being at 12s. 8d. per ton] - - - - - -	0	12	6
Labor and other charges - - -	1	0	0
	£1	12	6
Produce of 1000 kilogrammes.			
5 per cent of brown sugar—50 kil. [110 lbs.] - - - - - - - - - -	2	18	4
Molasses—40 kilogrammes [88 lbs.]	0	2	8
Pulp—300 kilogrammes [nearly 6 cwt.] - - - - - - - - - - -	0	3	9
	3	4	9
Deduct expenses - - - - -	1	12	6
Balance profit - - - - -	£1	12	3

In the above statement, if the value of the pulp and the molasses [6s. 5d.] be deducted from the expenses [£1 12s. 6d.], it will leave £1 6s. 1d., which sum divided by 110 [the number of lbs. of sugar] leaves a trifle over 3d. as the cost price of the sugar.

The Duke of Ragusa at Chatillon [1822].—Consumption 8000 kil. [7 tons 17 cwt.] of roots per day, since more than doubled.

Daily expenses 174 francs - - -	£7	5	0

Daily produce 150 kilogrammes [330 lbs.] brown sugar.

330 lbs. molasses, 14 francs - -	11s.	8d.
2200 lbs. pulp - 6 francs -	5	0
	16	8

Deducting this 16s. 8d. from the expenses, £7 5s., leaves 4½d. per lb. as the cost of the 330 lbs. of sugar.

M. Cafler, of Douay, though on the small scale of 1000 kilogrammes [2200 lbs.] in 150 days, does not estimate the cost of his brown sugar at more than 3½d to 4d. a pound.

In the above statements, there is only one instance [M. Crespel in which so large a produce has been obtained, as 5 per cent of sugar upon the gross weight of the raw root; [that is, if the weight of the crop be 20 tons an acre, for example, that of the sugar will be 20 cwt. or 1 ton.] But improvements of late have made such rapid strides, that this is now generally reckoned an average produce in France, and even as high as 6 per cent has been obtained, but as the beet-root, according to my friend Mr. Philip Taylor, actually contains 8 per cent*, who shall say that the maximum of improvement has been arrived at?

CHAP. XIX.

The adaptation of this manufacture to Great Britain.

The British farmer will perceive, from the previous statements, that this is no air-built speculation, no vision of the imagination; but, for the most part, a plain narrative of what has occurred, and what does actually occur every year in upwards of one hundred sugar-making establishments at this time in operation on

*See Farmer's Journal, March 30, 1829.

the other side of the channel. From these one hundred manufactories were obtained last year, five thousand tons of brown sugar, worth in the market £60 per ton, making a total of £300,000, and such is the spread of improvement, and the expected increase in the number of such establishments, that a much larger produce may be calculated on in future.

From all that has been said, there certainly appears every inducement to make the experiment in England; and though I hold it to be unsafe to trust too much to analogy in practical agriculture, yet I see no just cause why, if the making of sugar succeeds best, as it is found to do in the north of France, or that part where the climate most resembles England, it should not succeed at least as well in England itself. But we have no occasion to rely wholly on analogical reasoning in this matter. The beet-root of both countries has been carefully analyzed by practical chemists, and the English found to be fully equal to the French in amount of saccharine juice. There is then no *natural* obstacle to the conversion of this juice into sugar. But will not the government interpose to prevent the manufacture of an article which must, if carried to any great extent, interfere with our West India colonies? It is impossible at this time to say what course government may think proper to pursue in such a case. All we know is, that there exists at present no law to prevent the making of sugar in Great Britain. But the speculator will not, and ought not to rest satisfied with security like this. He must have full assurance that no after act of the legislature shall molest or injure him in the quiet enjoyment of his property. Without this assurance, no prudent man would embark his capital in such an undertaking. I would wish, therefore, not to be misunderstood on this point; for highly as I think of beet-root sugar as a business, I should be sorry to induce any one to adopt it inconsiderately and unavisedly. The prohibitory measures adopted by the government in the case of tobacco, have been instanced as an example of what would be done in that of beet-root sugar; but though I would on no account shut my own eyes, or those of others, to every objection likely to be raised against it, I own I do not think the two cases exactly similar. The cultivation of tobacco is attended with no additional outlay. It can be grown just as easily as beans, without materially interfering with the rotation of crops on a farm. The duty, it will be observed, is very heavy; and this circumstance, combined with the facility of obtaining the article, called for a porportionate rigor in the administration of the laws: in fact, a direct prohibition was the result; and those who had commenced the speculation, found themselves under the necessity of abandoning it; though, for the reasons above stated, the loss to individuals was not very heavy. That similar obstacles would not have to be encountered in the case of beet-root sugar, I am by no means prepared to deny. At the same time, it ought to be borne in mind that the circumstances differ widely from those under which tobacco was attempted to be raised in this country. A beet-root sugar manufactory necessarily requires the investment of a large capital; and, consequently, it is not very likely ever to become so general as the unrestricted culture of tobacco would have been. The duty (27s. a cwt.) is not so heavy, but that even if enforced to the utmost, the grower could still compete with the West India planter; therefore, the consumption remaining the same, the revenue would not suffer by the partial substitution of beet-root, for cane sugar. The only objection then, as it appears to me, is in the danger of its interference with the interests of our colonial possessions. That it would so interfere to an extent proportioned to the magnitude of the home manufacture, no one will attempt to deny, but even supposing that in a certain degree this should be the case, let us look to the situation of the British farmers, and through them to the increased and increasing wretchedness of the laboring poor, to the depressed state of our markets for almost every article of home production; and then ask if they ought in justice to be called upon to forego the advantages which are offered to them by an alluring though hitherto untrodden field of enterprise, merely because, at some distant period, the interests of the West India planters may be more or less affected by it? Injustice forms no item in my creed; but if the only alternative is a diminution, or even a total annihilation of slave labor abroad, and an encouragement of free labor at home, I can have no hesitation which to choose.

The following extract from an official document published in France, entitled, "*Report of the Commission of Inquiry, constituted by Royal Authority under the direction of the Minister of Commerce and Manufactures, to investigate certain questions of Commercial Legislation,*" will show the importance there attached to the home sugar manufactory. After recommending that the import duty upon iron should remain the same, in order to give a preference to their own manufactures, the report goes on to say—

"As regards sugar, the state of the question is very nearly the same. The object in view was to secure a preference in our markets to the sugar grown in our own colonies, over that coming from those of other countries, and at the same time to take care that the very low price of either should not become an obstacle to the propagation and the progress of a branch of the national industry altogether new, and the creation of which arose from the continental blockade at a time when colonial sugar cost five or six times more in France than in any other country. We speak of the art of extracting sugar from beet-root, the first attempts at which did not, as will be remembered, make the fortunes of those who engaged in them, and were very far from promising what we have good grounds at present to expect, or indeed the success that has been already obtained.

"One of the manufacturers examined before the commission has stated, that the beet-root sugar which he sells in the market at 1 franc 20 centimes the kilogramme, with a profit of 11 per cent, stood him 5 francs in the year 1811, on which he was satisfied to sustain a loss of 10 per cent. On the other hand, it appears from tables laid before the commission by the minister of commerce, that there are at present in France 89 sugar factories, the produce of which may be estimated at 4,400,000 kilogrammes; that is to say, equal to about a fifth of the quantity of foreign sugar consumed in France. This industry, it is said in the *exposé* of the minister, makes this very moment, as well by the preparations which are making for the erection of new factories as by the adoption of new pro-

cesses, an advance calculated to give a very rapid increase of production.

"But for this purpose it will be necessary that the duty should assist it for some years to come. The makers of native sugar insist, then, upon the keeping up of the present tariffs. Moreover, these manufacturers, admitting fully that beet-root sugar may and ought at some period to be taxed, maintain that to subject it at present to any duty whatever would be to ruin almost all the factories in existence, while it would at the same time prevent the creation of any new establishment. They also argue, that as long as we have colonies, it will be but justice to secure their produce a preference in our markets.

"To sum up, the commission of inquiry has come to this conclusion—that without at all diminishing the duty of 24f. 75c. upon the sugar of our own colonies, which raises their price on coming out of bond into the market to 71f. 75c. the quintal, the duty upon the sugar of foreign colonies has been fixed at 41f. 25c., so that they shall not be able to come into market at less than 78f. 75c. per quintal.

"And with respect to the home-made sugar—that from beet-root—while the just right to impose a duty upon it at some time or other, similar to that now imposed on wines, is not given up, the commission has thought fit to anticipate nothing in this respect; their wish is, that until an altered state of circumstances shall arise, the home-made sugar shall be free from all duty whatsoever.

"Thus the most important result of these branches of the inquiry will be, that for the present there is to be scarcely any change in the tariff of duties, and in the state of affairs, so far as iron and sugar are concerned."

But it has been argued, and with some degree of plausibility, that a general adoption of this manufacture in England is unadvisable, inasmuch as every acre of land so occupied, will subtract so much from the breadth of corn grown; and, consequently, that a positive injury will be inflicted, in exchange for at best an uncertain good. This, I say, is the drift of the argument; but to those who are acquainted with the management of land, it will be sufficient to remark, that the mangel wurzel intended for sugar will form, as now for cattle, only one certain defined portion of the farm called *a shift*, generally consisting of about a fourth of the arable land—for instance, if 200 acres are under the plough, they will be thus divided—

50 acres mangel wurzel,
50 " barley or oats,
50 " clover,
50 " wheat.

I am aware that the substitution of mangel wurzel for turnips may be objected to, as not affording a sufficiency of food for sheep, without which the land cannot be kept in good heart. On this I would only remark, that for the sake of ensuring a produce so important and so profitable as sugar, it is not unreasonable to expect that some sacrifice should be made on the part of the farmer; and I readily admit, that to a certain extent, this sacrifice must consist in an abridgment of the supplies of winter food for the flock, and an infringement on the customary mode of consuming it on the ground. I have called it the *customary* mode, but it is well known that such is only the case on light dry soils, and that on those of a contrary description, the whole crop is not unfrequently carted off the field; the larger roots to be consumed by bullocks, in yards and home-stalls; and the tops, offal, &c., by sheep and lean stock on the pastures, or some dry contiguous inclosure, usually a wheat stubble. Now, the offal of the mangel wurzel, consisting of the tops and cuttings of the plants, may be disposed of in a similar manner for the stock sheep; and those intended for fattening must be provided with oil-cake, corn, or other artificial food, a practice which, however undesirable, and even indefensible in common cases, is both allowable and desirable where a crop so profitable, as sugar is said to be, furnishes the means of purchasing them.

In like manner the making of sugar on a farm has been objected to, as tending to the permanent injury of the land by the abstraction of the best parts of the roots, viz. their saccharine juices; thereby depriving the land of so much manure as these, if consumed by cattle, would produce. How, it has been asked, can we reasonably expect that the pulp, the mere residuum after the nutritious particles of the root have been taken from it, should possess any powers to fatten cattle, much less any powers at all equal to those possessed by the root itself when given whole, as it grew? I know of no better answer to this question, than by appealing to the practice of those who are in the habit of using it, year after year, on a large scale. From 100 to 150 bullocks are not unfrequently fattened in a season in one of these sugar-making establishments in France. They are there usually bought in at £5 and sold out at £11 each. "But the weight of nutritive matter is so much diminished by pressing out the juices, that surely a great loss much be occasioned thereby." A loss in *weight of root* there undoubtedly is, as we have already shown, 34 tons of root yielding but 10 tons of pulp. A beast is allowed 55 lbs. (say in round numbers ½ cwt.) of pulp per day. The same beast would consume of raw root 1 cwt. in a day, therefore the 10 tons of pulp would last as long as 20 tons of root. But there were 34 tons pressed; consequently these 34 tons ought, if these premises be correct, to be equal to 17 tons, instead of 10 tons of pulp. We have therefore a loss, or an apparent loss of 7 tons of pulp, equal, for fattening purposes, to 14 tons of root. This deficiency consists in the sugar and the aqueous matter; one part of which is turned to profit, the other it is well to be rid of; it being injurious rather than otherwise, especially for fattening cattle. The question, therefore, is, whether 20 tons of root, in which is included a considerable weight of aqueous and extraneous matter, are equal in point of nutriment to 10 tons of pulp which, though much of the saccharine juice has been extracted from it, has also been deprived of every particle that would tend to counteract the fattening properties of the root? I hardly think it would, and am inclined to the belief that 10 tons of pulp would, in a given time, produce much more beef than double the weight of raw root. In this opinion I am corroborated by a practice which, I am told, has of late obtained in Gloucestershire and part of Monmouthshire, namely, that of rasping and pressing the roots of the mangel wurzel, solely with a view to getting rid of the watery particles—the whole of the juice, sugar and all, (at least so much of it as with the common presses they can obtain,) is thus thrown

away. If *this* pays, surely the retaining the sugar, and only parting with the deleterious particles, will pay still better; for, as to the expense of the operation, it will cost no more to perform it well than inefficiently.

It will be recollected, too, that the animal charcoal, ashes, &c., made use of in the manufactory, are valuable additions to the manure of a farm, and, in the opinion of many, fully counterbalance any loss occasioned by the deprivation of the saccharine matter contained in the roots.

From the Papers of the Agricultural Society of Albemarle.

AN ADDRESS DELIVERED BEFORE THE AGRICULTURAL SOCIETY OF ALBEMARLE, (VA.) ON TUESDAY, MAY 12, 1819. BY MR. MADISON, PRESIDENT OF THE SOCIETY.

It having pleased the Society to name me for their presiding member, I feel it a duty, on my first appearing among you, to repeat my acknowledgements, for that honorary distinction; with the assurances of my sincere desire to promote the success of an establishment, which has in view so valuable an object as that of improving the agriculture of our country.

The faculty of cultivating the earth, and of rearing animals, by which food is increased beyond the spontaneous supplies of nature, belongs to man alone. No other terrestrial being has received a higher gift than an instinct, like that of the beaver or the ant, which merely hoards for future use the food spontaneously furnished by nature.

As this peculiar faculty gives to man a pre-eminence over irrational animals, so it is the use made of it by some, and the neglect of it by other communities, that distinguish them from each other, in the most important features of the human character.

The contrast between the enlightened and refined nations on some parts of the earth, and the rude and wretched tribes on others, has its foundation in this distinction. Civilization is never seen without agriculture nor has agriculture ever prevailed, where the civilized arts did not make their appearance.

But closely as agriculture and civilization are allied, they do not keep pace with each other. There is probably a much higher state of agriculture in China and Japan, than in many other countries far more advanced in the improvements of civilized life. It is surely no small reproach to the latter, that with so great a superiority in science, and in the fuller possession of the auxiliary arts, they should suffer themselves to be outstripped in the very art by which both are essentially distinguished from the brute creation.

It must not be inferred, however, from the capacities and the motives of man for an artificial increase of the productions of the earth, that the transition from the hunter, or even the herdsman state, to the agricultural, is a matter of course. The first steps in this transition are attended with difficulty, and what is more, with disinclination.

Without the knowledge of the metals, and the implements made of them, the process of opening and stirring the soil, is not an easy operation; though one, perhaps not requiring more effort and contrivance, than produced the instruments used by savages in war and in the chase.

And that there is a disinclination in human nature to exchange the savage for the civilized life, cannot be questioned. We need not look for proofs beyond our own neighborhood. The Indian tribes have ever shown an aversion to the change. Neither the persuasive examples of plenty and comfort derived from the culture of the earth by their white brethren, nor the lessons and specimens of tillage placed in the midst of them, and seconded by actual sufferings from a deficient and precarious subsistence, have diverted them from their strong propensities and habitual pursuits. In the same spirit, they always betray an anxious disposition to return to their pristine life, after being weaned from it by time, and apparently moulded by intellectual and moral instruction, into the habits and tastes of an agricultural people. A still more conclusive evidence of the bias of human nature, is seen in the familiar fact, that our own people nursed and reared in these habits and tastes, easily slide into those of the savage, and are rarely reclaimed to civilized society with their own consent.

Had the Europeans, on their arrival, found this continent destitute of human inhabitants, whose dangerous neighborhood kept them in a compact and agricultural state, and had their communication with the countries they left, been discontinued, they might have spread themselves into the forests where game and fruits would have abounded; and gradually forgetting the arts no longer necessary to their immediate wants, have degenerated into savage tribes.

An admired historian,* in his inquiry into the origin of the American savages, represents any such degeneracy as impossible. He lays it down as a certain principle, that the necessary arts of life, when once introduced among a people, can never be lost, that the dominion over inferior animals once enjoyed will never be abandoned; and that America, consequently, must have been peopled from a country as uncivilized as itself. Yet he derives the American savages, generally, from the Tartars, whose example must have taught them the use of certain animals, for which a substitute might have been found in the bison or buffalo at least, (the same animal with the cow,) if not in the elk, the moese, or the caraboo. And he regards the Esquimaux, a tribe distinguished in several respects for their rude condition, as descendants from the Greenlanders, of the same modes of life with themselves who were a colony from Norway, planted in the 9th century; an epoch prior to which the Nowegians had made such progress in the arts as to be capable of formidable maritime expeditions. The Greenland colony, therefore, must have undergone a degeneracy from the condition of its parent country. Without supposing the possibility of a transition from a better state of human society, to a savage state, how would the learned historian have accounted for the introduction of the savage state at all?

The bent of human nature may be traced on the chart of our own country. The manufacturer readily exchanges the loom for the plough, in opposition often, to his own interest, as well as to

*Dr. Robertson.

that of his country. The cultivator, in situations presenting an option, prefers to the labors of the field, the more easy employment of rearing a herd. And as the game of the forest is approached, the hunting life displays the force of its attractions. Where do we behold a march in the opposite direction—the hunter becoming the herdsman the latter a follower of the plough—and the last repairing to the manufactory or the workshop?

Such indeed is the fascination of that personal independence which belongs to the uncivilized state, and such the disrelish and contempt of the monotonous labor of tillage, compared with the exciting occupations of the chase, or with the indolence enjoyed by those who subsist chiefly on the mere bounties of nature, or on their migratory flocks, that a voluntary relinquishment of these latter modes of life, is little to be expected. We certainly perceive nothing in the character of our savage neighbors, from which it could be inferred that even the germs of agriculture observed in their spots of maize, and a few other cultivated plants, would ever be developed into the extent implied by an agricultural life. To that little resource combined with the game furnished by the forests and by the lake or the stream, their population and habits are adjusted. There may be said, in fact, to be a plenum of the former; because it is commensurate with their food and this cannot be increased without a change of habits, which being founded in natural propensities, do not change of themselves.

The first introduction of agriculture among a savage people appears, accordingly, never to have taken place without some extraordinary interposition. Where it has not been obtruded by colonies transplanted from agricultural countries, as from Phœnicia and Egypt into Greece, and from Greece herself amongst her savage neighbors, the revolution has proceeded from some individual whose singular endowments and supernatural pretensions had given him an ascendency for the purpose. All these great reformers, in ancient times, were regarded as more than men, and ultimately worshipped as gods. A very remarkable example of modern date, is found in the revolution from the savage to the agricultural state, said to have been brought about by Manco Capac, among the Peruvians, to whom he represented himself as the offspring of the sun.

Agriculture once effectually commenced, may proceed, of itself, under impulses of its own creation. The mouths fed by it increasing, and the supplies of nature decreasing, necessity becomes a spur to industry, which finds another spur, in the advantages incident to the acquisition of property in the civilized state. And thus a progressive agriculture, and a progressive population ensue.

But, although no determinate limit presents itself to the increase of food, and to a population commensurate with it, other than the limited productiveness of the earth itself, we can scarcely be warranted in supposing that all the productive powers of its surface can be made subservient to the use of man, in exclusion of all the plants and animals, not entering into his stock of subsistence; that all the elements and combination of elements in the earth, the atmosphere and the water, which now support such various and such numerous descriptions of created beings, animate and inanimate, could be withdrawn from that general destination, and appropriated to the exclusive support and increase of the human part of the creation; so that the whole habitable earth should be as full of people, as the spots most crowded now are or might be made, and as destitute as those spots, of the plants and animals not used by man.

The supposition cannot well be reconciled with that symmetry in the face of nature, which derives new beauty from every insight that can be gained into it. It is forbidden also, by the principles and laws which operate in various departments of her economy, falling within the scope of common observation, as well as within that of philosophic researches.

The earth contains not less than thirty or forty thousand kinds of plants; not less than six or seven hundred of birds; not less than three or four hundred of quadrupeds; to say nothing of the thousand species of fishes. Of reptiles and insects, there are more than can be numbered. To all these must be added, the swarms and varieties of animalcules and minute vegetables not visible to the natural eye, but whose existence is probably connected with that of visible animals and plants.

On comparing this vast profusion and multiplicity of beings with the few grains and grasses, the few herbs and roots, and the few fowls and quadrupeds, which make up the short list adapted to the wants of man; it is difficult to believe that it lies with him, so to re-model the work of nature, as it would be re-modelled by a destruction, not only of individuals, but of entire species, and not only of a few species, but of every species, with the very few exceptions which he might spare for his own accommodation.

Such a multiplication of the human race, at the expense of the rest of the organized creation, implies that the food of all plants is composed of elements equally and indiscriminately nourishing all; and which consequently may be wholly appropriated to the one or few plants best fitted for human use.

Whether the food or constituent matter of vegetables, be furnished from the earth, the air or water, and whether directly, or by either, through the medium of the others, no sufficient ground appears for the inference that the food for all is the same.

Different plants require different soils; some flourishing in sandy, some in clayey, some in moist, some in dry soils, some in warm, some in cold situations. Many grow only in water—and a few subsist in the atmosphere. The forms, the textures, and the qualities of plants are still more diversified. That things so various and dissimilar in their organizations, their constitutions and their characters, should be wholly nourished by, and consist of precisely the same elements, requires more proof than has yet been offered.

A case which has been relied on to prove that different foods are not necessary for different plants, is that of grafting or inoculating one kind of plant on another kind; the sap obtained by the stock for itself, being found to feed and perfect the graft. But this operation has its limits. It does not extend beyond plants having a certain affinity. The apple tree may be planted on the pear or the quince. It will not succeed on the peach or the cherry. If the cases prove that the same food

suffices for the apple and the pear, they equally prove that different foods are required for the apple and the peach. It is said even, that the fruit from the peach-graft on the almond, is not precisely the same with that from a peach-graft on a plum.

It may be offered as another argument to the same effect, that all animal and vegetable decompositions answer indiscriminately as manures. The fact is not precisely so. Certain manures succeed best with certain plants. It is true, nevertheless, that animal and vegetable sabstances in a decomposed state, are generally manures for plants. Fish even, an animal from the water, is successfully used as a manure for Indian corn and other crops. But this and similar examples prove only that some ingredients are the same in all animals and plants, not that all the ingredients in each are the same.

The chemist, though as yet a fellow student as much as a preceptor of the agriculturist, justly claims attention to the result of his processes. From that source we learn that the number of known elements, not yet decomposable, is between forty and fifty; that about seven or eight belong to the organs of plants, that different elements enter into the composition of the same plant; and that they are combined in different numbers and in different proportions, in different plants. Supposing then, as must be supposed, that these different elements, in their actual quantities and proportions, are adapted to the quantities and the proportions of the existing varieties of plants; it would happen in so great a change as that in question, with respect to the number and variety of plants, that the quantities and the proportions of the elements, would not be adapted to the particular kinds and numbers of plants retained by man for his own use. Like the types of the alphabet, apportioned to the words composing a particlar book, when applied to another book materially different in its contents, there would be, of some a deficiency, of others a useless surplus.

Were it less difficult to admit that all the sources of productiveness could be exclusively appropriated to the food of man, is it certain that an obstacle to his indefinite multiplication would not be encountered in one of the relations between the atmosphere and organized beings?

Animals, including man, and plants may be regarded as the most important part of the terrestrial creation. They are pre-eminent in their attributes; and all nature teems with their varieties and their multitudes, visible and invisible. To all of them, the atmosphere is the breath of life. Deprived of it, they all equally perish. But it answers this purpose by virtue of its appropriate constitution and character. What are these?

The atmosphere is not a simple, but a compound body. In its least compound state, it is understood to contain, besides what is called vital air, others noxious in themselves, yet without a portion of which, the vital air becomes noxious. But the atmosphere in its natural state, and in its ordinary communication with the organized world, comprises various ingredients or modifications of ingredients, derived from the use made of it by the existing variety of animals and plants. The exhalations and perspirations, the effluvia and transpirations of these are continually charging the atmosphere with a heterogeneous variety and immense quantity of matter, which together must contribute to the character which fits it for its destined purpose, of supporting the life and health of organized beings. Is it unreasonable to suppose, that if, instead of the actual composition and character of the animal and vegetable creation, to which the atmosphere is now accommodated, such a composition and character, of that creation, were substituted, as would result from a reduction of the whole to man and a few kinds of animals and plants; is the supposition unreasonable that the change might essentially affect the aptitude of the atmosphere for the functions required of it; and that so great an innovation might be found, in this respect, not to accord with the order and economy of nature?

The relation of the animal part, and the vegetable part of the creation to each other, through the medium of the atmosphere, comes in aid of the reflection suggested by the general relation between the atmosphere and both. It seems to be now well understood, that the atmosphere, when respired by animals, becomes unfitted for their further use, and fitted for the absorption of vegetables; and that when evolved by the latter, it is refitted for the respiration of the former: an interchange being thus kept up, by which this breath of life is received by each, in a wholesome state, in return for it in an unwholesome one.

May it not be concluded from this admirable arrangement and beautiful feature in the economy of nature, that if the whole class of animals were extinguished, the use of the atmosphere by the vegetable class alone, would exhaust it of its life-supporting power; that in like manner, if the whole class of vegetables were extinguished, the use of of it by the animal class alone, would deprive it of its fitness for their support? And if such would be the effect of an entire destruction of either class, in relation to the other, the inference seems to press itself upon us, that so vast a change in the proportions of each class to the other, and in the species composing the respective classes, as that in question, might not be compatible with the continued existence and health of the remaining species of the two classes.

The immensity of the atmosphere, compared with the mass of animals and vegetables, forms an apparent objection only to this view of the subject. The comparison could at most suggest questions as to the period of time necessary to exhaust the atmosphere of its unrenewed capacity to keep alive animal or vegetable nature, when deprived either, of the support of the other. And this period contracts itself at once to the imagination, when it is recollected that the immensity of the atmosphere is the effect of its elasticity and rarefaction. We know, from the barometer, that condensed to the specific gravity of mercury, its rise above the surface of the earth would be but about thirty inches; and from the well pump, that condensed to the specific gravity only of water, which is nearly the same with that of the human body, its rise would be little more than as many feet; that is, a little more than five times the human stature. It is found that a single human person employs in respiration not less than sixteen or eighteen times his own weight of common air, in every twenty-four hours. In different degrees, some greater, some less, the case is the same with most other animals. Plants make a correspondent use of air for their purposes.

Other views of the economy of nature coincide with the preceding. There is a known tendency in all organized beings to multiply beyond the degree necessary to keep up their actual numbers. It is a wise provision of nature—1, to guard against the failure of the species; 2, to afford in the surplus, a food for animals whether subsisting on vegetables, or on other animals which subsist on vegetable. Nature has been equally provident in guarding against an excessive multiplication of any one species, which might too far encroach on others, by subjecting each, when unduly multiplying itself, to be arrested in its progress by the effect of the multiplication—1, in producing a deficiency of food; and where that may not happen—2, in producing a state of the atmosphere unfavorable to life and health. All animals, as well as plants, sicken and die in a state too much crowded. It is the case with our domestic animals of every sort, where no scarcity for food can be the cause. To the same laws, mankind are equally subject. An increase, not consisting with the general plan of nature, arrests itself. According to the degree in which the number thrown together exceeds the due proportion of space and air, disease and mortality ensue. It was the vitiated air alone, which put out human life in the crowded hole of Calcutta. In a space somewhat enlarged, the effect would have been slower, but not less certain. In all confined situations, from the dungeon to the crowded work-houses, and from these, to the compact population of overgrown cities, the atmosphere becomes in corresponding degrees, unfitted by reiterated use, for sustaining human life and health. Were the atmosphere breathed in cities, and not diluted, and displaced by fresh supplies from the surrounding country, the mortality would soon become general. Were the surrounding country, thickly peopled and not refreshed in like manner, the decay of health, though a later, would be a necessary consequence. And were the whole habitable earth covered with a dense population, wasteful maladies might be looked for, that would thin numbers into a healthy proportion.

Were the earth in every productive spot, and in every spot capable of being made productive, appropriated to the food of man; were the spade substituted for the plough, and all animals consuming the food of man, or food for which human food might be substituted, banished from existence, so as to produce the maximum of population on the earth, there would be more than an hundred individuals, for every one now upon it. In the actual population of many countries, it brings on occasional epidemics to be traced to no other origin than the state of the atmosphere. Increase the numbers to ten or twenty fold, and can it be supposed that they would, at any time, find the breath of life in a condition to support it; or if that supposition be admissible when limited to a single country, can it be admitted, when not only the contiguous countries, but the whole earth was equally crowded?

Must we then adopt the opinion entertained by some philosophers, that no variation whatever, in the numbers and proportions of the organized beings belonging to our globe, is permitted by the system of nature; that the number of species and of individuals in the animal and vegetable empires, since they attained a destined compliment, has been, and must always be the same; that the only change possible is in local augmentations and diminutions which balance each other, and thus maintain the established and unalterable order of things?

This would be the opposite extreme to that which has been rejected. Man, though so similar in his physical constitution to many other animals, is essentially distinguished from all other organized beings, by the intellectual and moral powers with which he is endowed. He possesses a reason and a will by which he can act on matter organized and unorganized. He can, by the exercise of these peculiar powers, increase his subsistence, by which his numbers may be increased beyond the spontaneous supplies of nature; and it would be a reasonable conclusion, that making as he does, in his capacity of an intelligent and voluntary agent, an integral part of the terrestrial system, the other parts of the system are so framed as not to be altogether unsusceptible of his agency, and unpliable to its effects.

This reasonable conclusion is confirmed by the fact, that the capacity of man, derived from his reason and his will, has effected an increase of particular plants and animals conducive to an increase of his own race; and a diminution of the numbers, if not of the species of plants and animals displaced by that increase.

Most, if not all of our domesticated animals probably exceed the numbers which, without the intervention of man, would be their natural amount; whilst the animals preying on, or interfering with them, are proportionably reduced in their numbers.

The case is the same with cultivated plants. They are increased beyond their natural amount; and banish, or proportionally reduce such as interfere with them.

Nor can it be said, that these changes made by human art and industry in some regions, are balanced by corresponding changes made by nature, in other regions. Take for examples, the articles of wheat, rice, millet, and maize, which are the chief food of civilized man; and which are now spread over such immense spaces. It is not possible to regard them as occupying no more than their original and fixed proportions of the earth: and that in other parts of it, they have disappeared in the same degree in which they are thus artificially extended. These grains belong to the torrid and temperate zones only; and so great a proportion of these zones have been explored, that it is certain, they could not have been displaced from other parts of the globe, in the degree in which they abound where they are now cultivated, and where it is certain they owe their abundance to cultivation. There must consequently be an absolute increase of them produced by the agency of man.

Take more particularly for an example, the article of rice, which constitutes so large a portion of human food. The latitudes to which its growth is limited by the nature of the plant, are for the most part so well known, that it may be assumed for an unquestioned fact, that this grain cannot always have prevailed any where, in the extent in which it is now cultivated. And it is equally certain that the vegetable productions belonging to the same climates, which must have been displaced by its cultivation, have not received an equivalent introduction and extension elsewhere.

It is remarkable that the vegetable productions most extensively used as human food, are but little, if at all found in their indigenous state; whether that state be the same as their present one, or a state from which they were improvable into their present state. They seem indeed not likely to flourish extensively in situations not prepared by the hand of man. The potato so recently brought into use, and now spreading itself over so great a surface, can barely be traced to a native state in the mountains of Chili, nor can it be believed, that previous to its adoption by man, it ever existed in the extent to which cultivation is now carrying it.

These views of the subject seem to authorize the conclusion, that although there is a proportion between the animal and vegetable classes of beings on our globe, and between the species in each class, with respect to which, nature does not permit such a change as would result from a destruction of the animals and vegetables not used by man; and a multiplication of the human race, and of the several species of animals and vegetables used by it, sufficient to fill up the void; yet that there is a degree of change which the peculiar faculties of man enable him to make, and by making which, his fund of subsistence and his numbers may be augmented; there being at the same time, whenever his numbers, and the change exceed the admitted degree, a tendency in that excess to correct itself.

Could it, however, be supposed that the established system, and symmetry of nature, required the number of human beings on the globe to be always the same; that the only change permitted in relation to them, was in their distribution over it; still, as the blessing of existence to that number would materially depend on the parts of the globe on which they may be thrown; on the degree in which their situation may be convenient or crowded; and on the nature of their political and social institutions; motives would not be wanting to obtain for our portion of the earth, its fullest share, by improving the resources of human subsistence, according to the fair measure of its capacity. For, in what other portion of equal extent will be found, climates more friendly to the health or congenial to the feelings of its inhabitants? In what other, a soil yielding more food with not more labor? And above all, where will be found institutions equally securing the blessings of personal independence, and of social enjoyments? The enviable condition of the people of the United States, is often too much ascribed to the physical advantages of their soil and climate, and to their uncrowded situations. Much is certainly due to these causes--but a just estimate of the happiness of our country, will never overlook what belongs to the fertile activity of a free people, and the benign influence of a responsible government.

In proportion as we relax the hypothesis which makes the aggregate number of mankind unsusceptible of change, and believe that the resources of our country may not only contribute to the greater happiness of a given number, but to the augmentation of the number enjoying a greater happiness, the motives become stronger for the improvement and extension of them.

But whilst all are sensible that agriculture is the basis of population and prosperity, it cannot be denied that the study and practice of its true principles have hitherto been too generally neglected in the United States; and that this state has at least its full share of the blame. Now only for the first time, notwithstanding several meritorious examples of earlier date, a general attention seems to be awakened to the necessity of a reform. Patriotic societies, the best agents for affecting it are pursuing the object with the animation and intelligence which characterize the efforts of a self-governed people, whatever be the objects to which they may be directed.

Among these promising institutions, I cannot glance at the names of those composing that of Albemarle, without being assured, that its full quota of information will be furnished to the general stock. I regret only, that my own competency bears so little proportion to my wishes to cooperate with them. That I may not be thought, however, deficient in good will; as well as in other requisites, I shall venture on the task, a task the least difficult, of pointing out some of the most prevalent errors in our husbandry, and which appear to be among those which may merit the attention of the society, and the instructive examples of its members.

1. The error first to be noticed is that of cultivating land, either naturally poor or impoverished by cultivation. This error, like many others, is the effect of habit, continued after the reason for it has failed. Whilst there was an abundance of fresh and fertile soil, it was the interest of the cultivator to spread his labor over as great a surface as he could. Land being cheap and labor dear and the land co-operating powerfully with the labor, it was profitable to draw as much as possible from the land. Labor is now comparatively cheaper and land dearer. Where labor has risen in price four-fold, land has risen ten-fold. It might be profitable, therefore, now to contract the surface over which labor is spread even if the soil retained its freshness and fertility. But this is not the case. Much of the fertile soil is exhausted, and unfertile soils are brought into cultivation; and both co-perating less with labor in producing the crop, it is necessary to consider how far labor can be profitably exerted on them; whether it ought not to be applied towards making them fertile rather than in further impoverishing them; or whether it might not be more profitably applied to mechanical occupations or to domestic manufactures.

In the old countries of Europe, where labor is cheap and land dear, the object is to augment labor and contract the space on which it is employed. In the new settlements taking place in this country, the original practice here may be rationally pursued. In the old settlements, the reason for the practice in Europe is becoming daily less inapplicable, and we ought to yield to the change of circumstances by forbearing to waste our labor on land, which besides not paying for it, is still more impoverished and rendered more difficult to be made rich. The crop which is of least amount gives the blow most mortal to the soil. It has not been a very rare thing to see land under the plough not producing enough to feed the ploughman and his horse; and it is in such cases that the death blow is given. The goose is killed without even obtaining the coveted egg.

There cannot be a more rational principle in the code of agriculture, than that every farm which is

in good heart, should be kept so; that every one not in good heart should be made so; and that what is right as to the farm generally, is so as to every part of every farm. Any system, therefore, or want of system, which tends to make a rich farm poor, or does not tend to make a poor farm rich, cannot be good for the owner, whatever it may be for the tenant or superintendant, who has a transient interest only in it. The profit, where there is any, will not balance the loss of intrinsic value sustained by the land.

II. The evil of pressing too hard on the land has also been much increased by the bad mode of ploughing it. Shallow ploughing, and ploughing up and down hilly land have, by exposing the loosened soil to be carried off by rains, hastened more than any thing else, the waste of its fertility. When the mere suface is pulverized, moderate rains on land but little uneven, if ploughed up and down, gradually wear it away .And heavy rains on hilly land ploughed in that manner, soon produce a like effect, notwithstanding the improved practice of deeper ploughing. How have the beauty and value of this ridge of country suffered from this cause? And how much is due to the happy improvement introduced by a member of this society, whom I need not name,* by a cultivation in horizontal drills, with a plough adapted to it? Had the practice prevailed from the first settlement of the country, the general fertility would have been more than the double of what the red hills, and indeed all other hilly lands now possess; and the scars and sores now defacing them would no where be seen. Happily, experience is proving that this remedy aided by a more rational management in other respects, is adequate to the purpose of healing what has been wounded, as well as of preserving the health of what has escaped the calamity. It is truly gratifying to observe how fast the improvement is spreading from the parent example. The value of our red hills, under a mode of cultivation, which guards their fertility against wasting rains, is probably exceeded by that of no uplands whatever; and without that advantage, they are exceeded in value by almost all others. They are little more than a lease for years.

Besides the inestimable advantage from horizontal ploughing, in protecting the soil against the wasting effect of rains, there is a greater one, in its preventing the rains themselves from being lost to the crop. The Indian corn is the crop which most exposes the soil to be carried off by the rains, and it is at the same time the crop, which most needs them. Where the land is not only hilly, but the soil thirsty, (as is the case particularly throughout this mountainous range) the preservation of the rain as it falls, between the drilled ridges, is of peculiar importance; and its gradual settling downwards to the roots, is the best possible mode of supplying them with moisture. In the old method of ploughing shallow with the furrows up and down, the rain, as well as the soil, was lost.

III. The neglect of manures is another error which claims particular notice. It may be traced to the same cause with our excessive cropping. In the early stages of our agriculture, it was more convenient and more profitable to bring new land into cultivation, than to improve exhausted land. The failure of new land has long called for the improvement of old land; but habit has kept us deaf to the call.

Nothing is more certain than that continual cropping without manure deprives the soil of its fertility. It is equally certain, that fertility may be preserved or restored, by giving to the earth animal or vegetable manure equivalent to the matter taken from it; and that a perpetual fertility is not, in itself, incompatible, with an uninterrupted succession of crops. The Chinese, it is said, smile at the idea that land needs rest, as if like animals, it had a sense of fatigue. Their soil does not need rest, because an industrious use is made of every fertilizing particle, that can contribute towards replacing what has been drawn from it. And this is the more practicable with them, as almost the whole of what is grown on the farms is consumed within them. That a restoration to the earth of all that annually grows on it, prevents its impoverishment, is sufficiently seen in our forests; where the annual exuvæ of the trees and plants, replace the fertility of which they deprive the earth. Where frequent fires destroy the leaves and whatever else is annually dropped on the earth, it is well known that the land becomes poorer; this destruction of the natural crop having the same impoverishing effect as the removal of a cultivated crop. A still stronger proof that an annual restoration to the earth of all its annual product will perpetuate its productiveness is seen where our fields are left uncultivated and unpastured. In this case, the soil receiving from the decay of the spontaneous weeds and grasses, more fertility than they extract from it, is for a time at least, improved, not impoverished. Its improvement may be explained, by the fertilizing matter, which the weeds and grasses derive from water and the atmosphere, which forms a net gain to the earth. At what point, or from what cause, the formation and accumulation of vegetable mould from this grain ceases, is not perhaps very easy to be explained. That it does cease, is proved by the stationary condition of the surface of the earth in old forests; and that the amount of the accumulation varies with the nature of the subjacent earth, is equally certain. It seems to depend also on the species of trees and plants which happen to contribute the materials for the vegetable mould.

But the most eligible mode of preserving the richness, and of enriching the poverty of a farm is certainly that of applying to the soil a sufficiency of animal and vegetable matter in a putrified state, or a state ready for putrefaction, in order to procure which, too much care cannot be observed in saving every material furnished by the farm.—This resource was among the earliest discoveries of men living by agriculture; and a proper use of it has been made a test of good husbandry in all countries, ancient and modern, where its principles and profits have been studied.

Some farmers of distinction, headed by Tull, supposed that mere earth, in a pulverized state, was sufficient without manure, for the growth of plants; and consequently, that continued pulverization would render the soil perpetually productive; a theory, which never would have occurred to a planter of tobacco or of Indian corn, who finds the soil annually producing less and less, un-

*Col. T. M. Randolph.

der a constant pulverizing course. The known experiment of Van-Helmont, seemed to favor the opposite theory, that the earth parted with nothing towards the plants growing on it. If there were no illusion in the case, the earth used by him must, at least, have been destitute of vegetable mould. For, in an experiment by Woodhouse, a garden mould was diminished in its weight by a plant which grew in it. And the latest chemical examination of the subject coincide with the general opinion of practical husbandmen that the substance of plants, partakes of the substance of the soil.

The idea is, indeed, very natural that vegeta matter which springs from the earth, and of itself returns to the earth, should be one source at least of the earth's capacity to re-produce vegetable matter.

It has been asked how it happens that Egypt and Sicily, which have for ages been exporting their agricultural produce without a return of any equivalent produce, have not lost their re-productive capacity. One answer has been, that they have lost no small degree of it. If the fact be otherwise with regard to Egypt, it might be accounted for by the fertilizing inundations of the Nile. With regard to Sicily, there may be something in the system of husbandry, or some particular local circumstances, which countervail the continued asportation of the fruits of the soil. But it is far more probable, that the island is less productive than it once was. It is certainly less of a granery for other counties now, than it was when it received that title from the ancient Romans. And its population being diminished, the internal consumption must also be diminished. If a single farm is rendered less productive by a continued removal of its crops without any adequate returns, no reason occurs why it should not happen to a number of farms multiplied to the extent of a whole country.

And that individual farms do lose their fertility in proportion as crops are taken from them, and returns of manure neglected, is a fact not likely to be questioned.

If it were, Virginia, unfortunately, is but too capable of furnishing the proofs. Her prevailing crops have been very exhausting, and the use of manures has been particularly neglected.

Tobacco and Indian corn, which, for a long time on the east side of the Blue Mountains were the articles almost exclusively cultivated, and which continue to be cultivated, the former extensively, the latter universally, are known to be great impoverishers of the soil. Wheat, which has for a number of years, formed a large portion of the general crop, is also an exhausting crop. So are rye and oats, which enter occasionally into our farm system.

With so many consumers of the fertility of the earth, and so little attention to the means of repairing their ravages, no one can be surprised at the impoverished face of the country; whilst every one ought to be desirous of aiding in the work of reformation.

The first and main step towards it, is, to make the thieves restore as much as possible of the stolen fertility. On this, with other improvements which may be made in our husbandry, we must depend for the rescue of our farms from their present degraded condition.

Of tobacco, not a great deal more than one half of the entire plant is carried to market. The residue is an item on the list of manures: and it is known to be in its quality a very rich one. The crop of tobacco, however though of great value, covers but a small proportion of our cultivated ground, and its offal can of course contribute but inconsiderably to the general stock of manure. It is probable also that what it does contribute, has been more carefully used as a manure, than any other article furnished by our crops.

The article which constitutes our principal manure is wheat straw. It is of much importance, therefore to decide aright on the mode of using it. There are three modes: 1. Carrying it from the farm yard, after having passed through or being trodden and enriched by cattle. In that mode, the greater part of it must be used, if used at all: the straw going through that process, being a necessary part of the food allotted to the cattle. To derive the full advantage from it, it ought to be hauled out before the substance has been wasted by rain, by the sun, and by wind; and to be buried in the earth as soon after as possible. 2. Spreading the straw on the surface of the ground. Many respectable farmers are attached to this mode, as protecting the soil from the sun: and by keeping it most, favoring the vegetation underneath, whether spontaneous or artificial; whilst the straw itself is gradually decomposed into a manure. The objection to this mode is the loss by evaporation, before this last effect is obtained. 3. Turning the straw at once under the surface of the earth. This would seem to be the best mode of managing manures generally; least of their substance being then lost. When the grain is trodden out from the straw, it is left in a state easily admitting this operation. Some difficulty may attend it, when the grain is thrashed from the straw by the flail, or by the machines now in use, neither of which break the straw sufficiently to pieces.

It may be remarked with regard to this article of manure—1. That its weight is barely more than that of the grain. 2. That the grain is the part which makes the greatest draft on the fertility of the earth. 3. That the grain is for the most part not consumed within the farm. It is found on trial that a stalk of wheat, as generally cut, including the chaff, and the grains borne by the stalk, are pretty nearly of equal weight. The case is probably the same with rye, and not very different with oats. The proportion of fertilizing matter in the straw, to that in the grain, has not, as far as I know, been brought to any satisfactory test. It is doubtless much less in the straw, which alone in the case of wheat, is with us returnable in any form to the earth. This consideration, whilst it urges us to make the most of the article as a manure, warns us of its insufficiency.

The stubble and the roots of the small grains, not being taken from the earth, may be regarded as relapsing into a fertility equal to that of which they deprived the earth. This remark is applicable to all cultivated plants, the roots of which are not an esculent part.

An eminent citizen and celebrated agriculturist * of this state, has among other instructive lesons, called the public attention to the value of the corn stalk as a manure. I am persuaded that he has not overated it. And it is a subject

*Col. John Taylor.

of agreeable reflection that an article which is so extensively cultivated as that of Indian corn, and which is so particularly exhausting should be the one so capable of repairing the injury it does.

The corn stalk as a fodder is of great value. Not only the leaves, but the husk inclosing the ear, and the cob enclosed by it, are all more or less valuable food when duly preserved and dealt out to cattle. There is no better fodder than the leaves or blades for horses and oxen; nor any so much approved for sheep. The husk or shuck is a highly nourishing food for neat cattle. And the pickings of the stalk, even at a late season, and after much exposure to the weather, support them better than any of the straws. From the saccharine matter in the stalk, which is long retained about the joints, it cannot be doubted that if cut early, or before exposure to the weather, into parts small enough for mastification, it would well repay, as a food for cattle, the labor required for it.

The great value of the corn stalk, in all its parts as a fodder, was brought into full proof, by the use made of it during the late general failure of crops. It is to be hoped that the lesson will not be suffered to pass into oblivion.

But it is as a resource for re-fertilizing the soil, that the corn stock finds the proper place here; and as such, it merits particular notice; whether it be passed through animals, or be prepared by fermentation in the farm yard; or be merely spread on the surface of the earth, the mode in which its effect must be least considerable. The same qualities which render every part of it nutricious to animals, render it nutricious to the earth, and it is accompanied with the peculiar advantages: 1, that the grain itself is mostly every where, and altogether, in places distant from navigation, consumed within the farms producing it; 2, that as the grain is in greater proportion to the space on which it grows, than most other grains, so the rest of the plant is in greater proportion to the grain, than the rest of any other grain plant. The straw and chaff of the smaller grains, as already remarked, is in weight but about one half the grain. The corn stock with all its appurtenant offal, is of not less than three times and if taken early from the field, probably of not less than four or five times the weight of the grain belonging to it. 3. The fertilizing matter contained in the corn stalk is greater, in proportion to its weight, than that contained in the straw and offal of other grains is to the weight of the straw and offal.

Would it be hazarding too much to say, that where a level surface, or the mode of cultivating a hilly one, prevents the rains from carrying off the soil, a restoration of an entire crop of Indian corn, in the form of manure, to the space producing it (there being no other intervening crop not so restored) would replace the fertility consumed by the crop, and maintain a perpetual productiveness? Reason, the case of forest and fallow fields, where the spontaneous crop falls back of itself, to the earth and the Chinese example, where the cultivated crop is restored to the earth, all pronounce that such would be the effect. And yet the fact stares us in the face, that our most impoverished fields, even the most level of them, owe their condition more to the crops of Indian corn, than to any other crops.

The articles of fodder, which are least neglected as a fund of manure, are timothy and clover hays. But the average quantities on farms, is not as yet, very great; and seldom yield more than stable manure for gardens and culinary crops.

The cotton plant, which is so extensive a crop in the more southern and the south-western states is but little cultivated in Virginia, and scarcely at all in this part of it. I am not able to say how far it is comparatively an exhausting crop. But it would seem to be more capable than any other crop, not wholly consumed within the farm, preserving its fertility. The only part of the plant carrried away, is the cotton fibre or wooly part, which bears an inconsiderable proportion to the other parts in weight and as may be inferred, in fertilizing matter also. The seed alone, passing by the ball and the haulm, is three times its weight, and contains the chief part of the oil in the plant. In the countries where cotton makes the principal part of the crop, the superfluous seed must deserve great attention as a manure. Where the fields are level or cultivated in horizontal drills, it might go far torwads supporting a continued cropping without a diminished fertility.

The sum of these remarks on cultivating poor land, and neglecting the means of keeping or making land rich is, that if every thing grown on a soil is carried from it, it must become unproductive; that if every thing grown on it be directly or indirectly restored to it, it would not cease to be productive; and consequently, that according to the degree in which the one or the other practice takes place, a farm must be impoverished, or be permanently productive and profitable. Every acre made by an improved management to produce as much as two acres, is in effect, the addition of a new acre; with the great advantages of contracting the space to be cultivated; and of shortening the distance of transportation between the fields, and the barn, or the farm-yard. One of the Roman writers, * on husbandry, enforces the obligation to an improving management by a story of one Paradius who had two daughters and a vineyard. When the elder was married he gave her a third part of the vineyard; notwithstanding which, he obtained from two thirds the same crop as from the whole: when his other daughter was married, he portioned her with the half of what remained; and still the produce of his vineyard was undiminished. The story, short as it is, contains a volume of instruction.

The plaster or gypsum, though not a manure within the farm itself, has been too long neglected as a fertilizing resource. It is now beginning to take a high and just rank as such. The proofs of its efficacy are as incontestible as the causes of it are obscure. The experiments of a very distinguished chemist, † led him to the opinion, that its substance enters into the substance of the plant. Without doubting the fact, it does not sufficiently account for the addition made to the size and weight of the plant, which greatly exceed the quantity of the plaster. It must, therefore, have some further mode of operating. Whether it be by neutralizing some noxious ingredient in the earth, one of the modes by which lime is supposed to operate; or by attracting and convey-

*Columella.

†Sir H. Davy.

veying to the plant, food from the earth, the air or water; or by exciting the plant to a more active use of its feeding powers, whatever they be: or by its accretion and assimulation to particular parts of plants on which these powers depend; thereby augmenting and strengthening those particular parts, and enabling the feeding powers to give proportional augmentation to every o her part; whether by any one or more of these processes, or by some other or others distinct from them all, the growth of plants be promoted by this mineral, remains, it would seem, to be yet explained. In the mean time, a more extensive use of it, promises much advantage to our agriculture. I take it, however, that this advantage cannot be permanent without making the increased product of the soil, a source of manure to the soil. That the effect of the plaster will be continued indefinitely, under a constant removal of the whole crop from the soil, surpasses belief. It can scarcely fail to exhaust at length, the productive powers of the earth. The period of time necessary for the purpose, may be uncertain; but that as in the case of other mineral manures, lime and marl, such must sooner or later, be the result, cannot well be so. The effect of pulverizing the earth by tillage, as practised by Tull, is stated to have been uninterrupted crops of wheat, without manure, for more than twenty years; which was regarded as a demonstration, that tillage was a complete substitute for manure. Supposing the statement to be free from error, the inference is certainly not warranted by the fact. We know that some of our soils, not naturally richer than the hilly manured soils on which Tull probably commenced his tillage, will bear a succession of crops for an equal period; and we know as well, that their fertility will not hold out forever. How long plaster, whatever be its mode of operation, will hold out, may not yet have been fully tried. But to make it permanently successful, it will be wise to take for granted, that it must be made a source of future manure, as well as of immediate productiveness. If the crop, as augmented by the plaster, be given back to the soil, the soil may be benefitted more than it would be by the return of a crop not augmented by the plaster. And in this way, fertility may be accelerated. The restoration of a crop, increased by ordinary cultivation, to the soil on which it grew, would, I presume, fertilize it more than the restoration of a smaller crop spontaneously produced; although in both cases, the whole taken from the soil would return to it.

IV. Among the means of aiding the productiveness of the soil, which have not received merited attention, is irrigation. In scarcely any country does this resource abound more than in the United States; nor is there any, where there is so little sensibility to its value. The inconsiderable use made of it, is chiefly by emigrants, particularly Germans, or the immediate descendants of them. I have understood that the market of Baltimore, has been much benefitted in dry seasons, by the irrigation introduced by exiles from St. Domingo. For a distinguished proof of the importance of the practice, I may refer to the fact which has been stated in the neighborhood of Barcelona in Spain, where a part of the land is under irregation, and a part is not susceptible of it, both being otherwise of equal fertility, the part irrigated is of double the price in market. It is to be noted indeed that the climate is a dry one, and that the article cultivated is lucerne. But this is a plant, which though much aided in its growth by moisture, is at the same time remarkable for the length of a tap-root, and fitted by that, as well as by the absorbent quality of its leaves, to flourish in a thirsty soil, and warm climate. Our particular district of country, abounding in springs, small streams, and suitable declivities, admits greatly of irrigation; and being generally of a thirsty nature, the more strongly invites the use of it.

V. I cannot but consider it as an error in our husbandry, that oxen are too little used in place of horses.

Every fair comparison of the expense of the two animals, favors a preference of the ox. But, the circumstance particularly recommending him is, that he can be supported when at work, by grass and hay, whilst the horse requires grain and much of it; and the grain generally given him, is Indian corn, the crop which requires most labor and greatly exhausts the land.

From the best estimate I have been enabled to form, more than one-half of the corn crop is consumed by horses, including the ungrown ones; and not less than one half, by other than pleasure horses. By getting free from this consumption, one half the labor and of the wear of the land would be saved, or rather more than one half; for on most farms, one half of the crop of corn grows on not more than two-fifths, and sometimes a smaller proportion of the cultivated fields; and the more fertile fields would of course be retained for cultivation. Every one can figure to himself the ease and conveniency of a revolution which would so much reduce the extent of his corn fields; and substitute for the labor bestowed on them, the more easy task of providing pasturage and hay.

But will not the ox himself when kept at labor, require grain food as well as the horse? Certainly much less, if any. Judging from my own observation, I should say, that a plenty of good grass or good hay will suffice without grain where the labor is neither constant nor severe. But I feel entire confidence in saying that a double set of oxen alternately at work, and therefore half the time at rest, might be kept in good plight without other food than a plenty of good grass or good hay. And as this double set would double the supply of beef, tallow and leather, a set off is found in that consideration for a double consumption of that kind of food.

The objections generally made to the ox are—1. That he is less tractable than the horse. 2. That he does not bear heat as well. 3. That he does not answer for the single plough used in our corn fields. 4. That he is slower in his movements. 5. That he is less fit for carrying the produce of the farm to market.

The first objection is certainly founded in mistake. Of the two animals, the ox is the more docile. In all countries where the ox is the ordinary draught animal, his docility is proverbial. His intractability where it exists, has arisen from an occasional use of him only, with long and irregular intervals; during which, the habit of discipline being broken, a new one is to be formed.

The second objection has as little foundation. The constitution of the ox accommodates itself, as readily as that of the horse, to different climates.

Not only in ancient Greece and Italy, but throughout Asia, as presented to us in ancient history, the ox and the plough are associated. At this day, in the warm parts of India and China, the ox not the horse is in the draught service. In every part of India, the ox always appears, even in the train of her armies. And in the hottest parts of the West Indies, the ox is employed in hauling the weighty produce to the sea-ports. The mistake here, as in the former case, has arisen from the effect of an occasional employment only, with no other than green food. The fermentation of this in the animal heated by the weather, and fretted by the discipline, will readily account for his sinking under his exertions, when green food even, much less dry, with a sober habit of labor, would have no such tendency.

The third objection also, is not a solid one. The ox can, by a proper harness, be used singly as well as the horse, between the rows of Indian corn; and equally so used for other purposes. Experience may be safely appealed to, on this point.

In the fourth place, it is alledged that he is slower in his movements. This is true; but in a less degree than is often taken for granted. Oxen that are well chosen for their form, are not worked after the age of about eight years, (the age at which they are best fitted for beef,) are not worked too many together and are suitably matched, may be kept to nearly as quick a step as the horse. May I not say, a step quicker than that of many of the horses we see at work, who on account of their age, or the leanness occasioned by the costliness of the food they require, loose the advantage where they might have once had it?

The last objection has most weight. The ox is not as well adapted as the horse to the road service, especially for long trips. In common roads, which are often soft, and sometimes suddenly become so, the form of his foot, and the shortness of his leg, are disadvantages; and on roads frozen or turnpiked, the roughness of the surface in the former case, and its hardness in both cases, are inconvenient to his cloven hoof. But where the distance to market is not great, where the varying state of the roads and of the weather can be consulted; and where the road service is in less proportion to the farm service, the objection is almost deprived of its weight. In cases where it most applies, its weight is diminished by the consideration that a much greater proportion of service on a farm may be done by oxen, than is now commonly done; and that the expense of shoeing them, is little different from that of keeping horses shod. It is observable, that when oxen are worked on the farm, over rough frozen ground, they suffer so much from the want of shoes however well fed they may be, that it is a proper subject for calculation, whether true economy does not require for them, that accomodation, even on the farm, as well as for the horses.

A more important calculation is, whether in many situations, the general saving by substituting the ox for the horse, would not balance the expense of hiring a carriage of the produce to market. In the same scale with the hire, is to be put the value of the grass and hay consumed by the oxen; and in the other scale, the value of the corn, amounting to one half of the crop, and of the grass and hay consumed by the horses. Where the market is not distant, the value of the corn saved, would certainly pay for the carriage of the market portion of the crop, and balance, moreover any difference between the value of the grass and hay consumed by oxen, and value of the oxen when slaughtered for beef. In all these calculations, it is doubtless proper not to lose sight of the rule, that farmers ought to avoid paying others for doing what they can do for themselves. But the rule has its exceptions: and the error, if it be committed, will not lie in departing from the rule, but in not selecting aright the cases which call for the departure. It may be remarked, that the rule ought to be more or less general as there may, or may not be at hand, a market by which every produce of labor is convertible into money. In the old countries, this is much more the case than in new, and in new, much more the case near towns, than at a distance from them. In this, as in most other parts of our country, a change of circumstances is taking place which renders every thing raised on a farm more convertible into money than formerly; and as the change proceeds, it will be more and more a point for consideration, how far the labor in doing what might be bought, could earn more in another way, than the amount of the purchase. Still it will always be prudent for reasons which every experienced farmer will understand, to lean to the side of doing, rather than hiring or buying what may be wanted.

The mule seems to be in point of economy, between the ox and the horse, preferable to the latter, inferior to the former, but so well adapted to particular services that he may find a proper place on many farms. He is liable to the objection which weighs most against the ox. He is less fitted than the horse for road service.

VI. A more manifest error in the husbandry of the older settlements, is that of keeping too many neat cattle on the farms. As a farm should not be cultivated farther than it can be continued in good heart, the stock of cattle should not be in greater number than the resources of food will keep in good plight. If a poor farm be unprofitable, so are poor cattle. It is particlarly the case with the milch cows. When the whole of the food given them is necessary to support a lean existence, no part can be spared for the milk pail. The same food, given to the proper number, will not only keep them in a thrifty state, but enable them to supply the dairy. Even the manure from several poor cattle is worth less than that from a single fat one. The remark holds equally good with respect to the hide.

The misjudged practice in question, is another effect of inattention to the change of circumstances through which our country has passed. Originally, the forest abounded in rich herbage which fed and fatted, without expense, all the cattle that could be brought through the winter into the spring. It was natural, at that time, to keep as large a stock as could be preserved through the winter. For a long time past, the forest is scarcely any where, a resource for more than two or three months, and in many places, no resource at all. A greater difficulty is often felt in finding summer, than winter subsistence. And yet, where no inclosed pasturage is provided to take the place of the extinct one in the forest, the habit, founded in reasons which have entirely ceased, is but too generally retained. The same number of cattle

is aimed at, as if the forest was ready to receive and fatten them now, as formerly. The size and appearance of our neat cattle, compared with those for which nature or good husbandry has provided sufficient food, are proofs that their food is not in proportion to their number; and that where the food cannot be increased, the number ought to be reduced.

VII. Of all the errors in our rural economy, none is perhaps so much to be regretted, because none is so difficult to be repaird, as the injudicious and excessive destruction of timber and fire wood. It seems never to have occurred that the fund was not inexhaustible, and that a crop of trees could not be raised as quickly as one of wheat or corn.

Here again, we are presented with a proof of the continuance of the practice for which the reasons have ceased. When our ancestors arrived, they found the trees of the forest the great obsticle to their settlement, and cultivation. The great effort was of course to destroy the trees. It would seem that they contracted and transmitted an antipathy to them; for the trees were not even spared around the dwellings, where their shade would have been a comfort and their beauty an ornament; and it is of late years only, that these advantages have been attended to. In fact, such has been the inconsiderate and indiscriminate use of the axe, that this country is beginning to feel the calamity as much as some of the old countries of Europe; and it will soon be forced to understand the difficulty of curing it. A vast proportion of the farms on the eastern side of the Blue Ridge, and some even, on the other side, have but a scanty fund for present use, and are without a fund for permanent use. And to increase the evil, the remnant of timber and fuel on many farms, inadequate as it is left in situations remote from the dwelling, and incapable of being divided, according to the divisions, and sub-divisions, into which all the large farms must be rapidly forced by the law of descendants, the impulses of parental affection, and other causes.

It is high time for many farmers, even in this quarter, and still more so in the country below us, to take this subject into serious consideration. Prudence will no longer delay to economize what remains of wood land; to foster the second growths where taking place in convenient spots; and to commence, when necessary, plantations of the trees recommended by their utility and quickness of growth.

I wish I could more satisfactorily estimate the proportion of wood land which ought to belong to every farm, as a permanent fund of timber for building and repairing houses; for fences, where live or stone ones may not have been introduced; for wheel carriages, and the other apparatus needed on farms. The estimate is the more difficult, because it must be varied according to many circumstances; particularly according to the nature of the soil, and the kind of trees at once suited to it, and to the uses to be made of them.

Estimating the crop of wood yielded by an acre at twenty cords, the period of re-production at twenty years, and the average number of cords annually consumed at a fire place, including the culinary consumption, at ten cords; every fire place on a farm will require ten acres for a permanent supply of fuel. For the other necessities of the farm, several acres more ought to be added.

An estimate in a very sensible publication, entitled "the New England Farmer," makes seventeen acres necessary for a fire place. The winters there are longer, and the climate may be less favorable to the quick growth of trees. But their houses are generally closer than with us; to say nothing of a more judicious management than can be enforced on most of our farms.

To this catalogue of errors in our rural economy, considerable as it is, many, I fear, might be added. The task of pointing them out, I gladly leave to others, less incapable than I have shown myself to be by the very imperfect manner in which I have performed the one on which I ventured.

A PLAIN EXPLANATION OF THE DIFFERENT OPERATIONS OF BANKING, AND THEIR EFFECTS ON THE INTERESTS OF THE COMMUNITY.

Extract from the Report on the Renewal of Bank Charters,

Made to the Senate of Pennsylvania, by Mr. Raguet, Chairman, on the 15th of January, 1821.

The numerous evils which have been inflicted upon the people of the United States, within the last few years, by the abuses of the banking system, make a strong appeal to the feelings as well as to the understandings of those, who are invested with the power of legislation; and imperiously demand of them, so to direct their attention to the subject, as that their constituents may not again be visited by so destructive a calamity as that which has involved so many thousands in irretrievable ruin. Your committee are aware of the difficulties with which this subject is surrounded—of the conflicting opinions in relation to it entertained by our most respectable citizens—and of the impracticability of their being able so to elucidate the question, as to carry conviction to the minds of all. They flatter themselves, however, that they have it in their power to advance some principles connected with the matter referred to them, which, if adopted by the legislature, will in a great degree, if not effectually, guard the community against the inordinate and dangerous influence of monied institutions. The present moment is one peculiarly adapted for a cool, dispassionate investigation of this momentous subject. Some of the banks, whose charters will expire in the years 1824 and 1825, have *already* made applications for renewals of their charters, and as the public mind is in a great degree divested of those tumultuous passions, which during the pressure arising from the rapid reduction of bank loans, every where prevailed, our citizens can now soberly reflect upon their condition, and deliberately judge of the true merits of the case.

An opinion is almost universally entertained,

That banks are useful to the public, inasmuch as they afford facilities in the safe keeping of money—in the payment of large sums by checks or transfers on their books—in the transmission of funds—in the furnishing of a convenient and portable currency—and in the loaning of money to merchants, farmers, and others who have occasion to borrow.

That they increase the *capital* of the community by the emission of their notes, and afford facilities to borrowers which could not exist without them—and

That they improve the country wherever they are located, as is exemplified in the number of turnpike roads, bridges, houses and barns, which have of late been constructed.

How far these positions are true or incorrect, will appear in the course of the following remarks. The first point to be attained, is to have a clear analytical view of the nature of banks, and of the *distinct operations* which they are capable of performing, for unless these be properly understood, the mind will necessarily be confused, and the conclusions drawn as to their beneficial or injurious tendency, will assuredly be unsound.

Banks may be of *three different kinds*, which are designated thus:—banks of *deposite*, banks of *discount*, and banks of *circulation*; the particular properties of which are wholly dissimilar, as well as relates to their uses, as to their influence upon the public prosperity.

A bank of deposite is an institution established under the guarantee of a state, or of one or more individuals, *solely* for the deposit and safe keeping of money, wherein each person who makes a deposite, has credit on the books of the bank for the amount of the same, which amount he can again at pleasure draw out, or transfer by a check or order, to the credit of another. Of the utility and convenience of such an institution, no one can entertain a doubt. It is calculated to protect the coin or bullion of the community, from the losses incident to fire or pillage, and enables merchants and others to settle extensive cash transactions without the labor of counting, or the expenses and risk attendant upon the transportation of coin from place to place. Such a bank might even issue notes for public convenience, without producing any prejudicial effect upon the currency, *provided* that such notes were mere *certificates* that corresponding sums had been deposited in the bank, *in coin*, which were always subject to the demand of the holders. The only objection against the establishment of a bank of this description is, that it could not be supported without a small contribution from each deposite and transfer, and such an expense would not, perhaps, be willingly borne by our citizens at the present day. The state, indeed, might make an appropriation for such a purpose, but the present is not possibly a period when such a measure is required.

A bank of discount is an institution established by an individual, or a number of capitalists, *who have money to loan*, and who associate themselves together for the purpose of finding a more ready market for their capital, or of saving themselves the trouble of looking out for borrowers. As the loans of such banks are limited to the *actual amount of its capital*, its operations are entirely favorable to the interests of the community. As it makes no addition to the circulating medium by the emission of its notes or credits, it has no tendency to depreciate the currency, and as it keeps in constant activity a considerable amount of capital which would otherwise lie unemployed in the hands of its owners, it may be considered as instrumental in the promotion of national wealth.

If the operations of the banks of Pennsylvania and the other states of the Union, were limited to those above described—if they would afford facilities in the depositing, safe-keeping, and transfering of money, as banks of deposite, and as banks of discount confine their loans to their absolute capital, without in either case, issuing any note but what should be the *true representative* of gold and silver in their vaults, then your committee would unite in regarding them as national blessings, worthy of legislative protection, and entitled to the support and confidence of the public. But unfortunately, the emoluments resulting from a mere loan of their *capitals*, do not constitute, in our country, a sufficient inducement for the establishment of banks. The expenses of management consume a portion of their profits, and a resort is had to the expedient of creating a revenue from the *lending of credit*, at the same annual interest as is derived from the *loaning of capital*. This gives rise to the *third* species of bank which has been enumerated.

A bank of circulation is one, which, in addition to its capital, undertakes to loan its *credit*, either in the form of credits on its books, or of bank notes, which are promises to pay *on demand*, certain quantities of gold and silver. *All the banks in the United States are of this description*, and it is this particular branch of their operations which has occasioned all the calamities which have been ascribed to *the banking system*. Your committee do not wish to be understood as declaring that the power of lending its *credit* may not be exercised *to a certain extent*, with advantage to the public. If a bank be established in a community where coin alone had before constituted the currency, the credit given to its notes may enable them to supply the place of *a part* of the coin, which may then be sent abroad as commercial capital, and be thus rendered productive of profit, instead of being retained at home in the unprofitable employment of circulation. If the paper credits emitted by the banks, do not exceed the quantity of coin displaced by them, or in other words, if the quantity of coin and convertible paper *united*, does not exceed the quantity of coin which would circulate if there was no paper, then there is no evil resulting from the exercise of the power to loan credit. But so strong are the temptations to overtrade, grounded in a desire to elevate the price of stock by declaring exorbitant dividends, and so pernicious the consequences which result to the community, from the existence, in the hands of any set of men, of a power to contract or expand the currency at pleasure, *which is virtually the power of altering at will the value of every citizen's property*, that the most approved writers on public economy unite in the declaration, that the evils attendant upon banks *of circulation* so far outweigh all their advantages, that that nation will be the most happy and prosperous which has the least to do with them. To render this position more intelligible, your committee subjoin the following remarks.

The total quantity of gold and silver in the trading world, in the course of a peaceful intercourse between nations, becomes distributed amongst them all, in the proportions called for by their population, commerce, and other relative circumstances. Each nation, which possesses the means of paying for it, will have its share, and neither government or people need be under any apprehension, least they may not receive that quantity which will place their currency upon a level with the average currencies of other countries. When

the currency of a country is composed entirely of coin, it is then the most sound and invariable, of which the nature of things will admit. It is then subject to no fluctuations but those which arise from the increase or diminution of the quantity of the precious metals throughout the world, which can never be rapid, and upon those general laws of supply and demand, which are the sure regulators of value. The prices of property and commodities under such circumstances, remain steady for long periods together. Speculative fortunes are rarely heard of, and the mass of the people, aware that *industry* is the only legitimate source of wealth, apply themselves to their respective employments, and depend upon their *labor*, not upon *chance*, for support. Such would be the state of things, even if there were banks of deposite and discount. As no power of creating *artificial* money, of investing a *shadow* with the appearance of *substance*, would any where exist, the solidity of the currency would not be disturbed; for *after* the organization of such banks, there would be neither more nor less money in the community than there was *before*. Such might even be the state of things if the circulating power was exercised to the extent we have prescribed, but only permit the boundary of prudence to be passed, and there is an end to stability. Houses, lands, commodities, and produce are alike cast upon the waves of speculation. The price of to-day is no criterion for the price of to-morrow, and the community, instead of having solid ground to move upon, resemble travellers treading upon quicksands, which threaten every moment to swallow them up.

So soon as bank notes or credits are issued beyond the point we have designated, the currency becomes depreciated from excess, below the currencies of other countries, inasmuch as we then have more coin and paper united, than the proportion which is required to maintain it at its proper level. With the depreciation of money, the *nominal prices* of property and commodities experience a rise, which having *the appearance* of a real enhancement of *value*, deceives the community, and invites to all the speculation, overtrading and imprudence, which are ever attendant upon fluctuations. The coin, soon finding itself involved in the depreciation brought on by an excess of paper, leaves the country, in order to seek abroard that value to which it is fairly entitled, and which it can no longer command at home. Export follows export, and the increasing demand made upon the banks by the returning of their notes for payment, finally compels them to make unexpected and urgent calls upon their debtors, which are followed by a general fall of prices to a point below what they originally stood at. Lands which before had been elevated to an artificial height, are suddenly depressed below their former price. Agricultural produce, merchandise, and other commodities, experience the same reduction, and a stagnation of trade, a suspension of industry, an unsettled state in the pursuits of the whole community, and the ruin of thousands, are the inevitable consequence. All these effects may take place from the overtrading of banks, even whilst they shall be enabled to meet the payment of their notes in coin, but they will be experienced in their most destructive stages, when a suspension of payment is the result of their imprudence and mismanagement. *Against such suspension the public have no guarantee, but in the imposition of the most rigorous restrictions.*

Having thus given an analysis of the banking system, your committee will proceed to consider how far the arguments in favor of banks above adduced, are in accordance with sound reason, for by no other criterion is it possible to judge of their truth or fallacy.

In the first place, then, it is said that banks are useful to the public, inasmuch as they afford facilities in the safe keeping of money, in the payment of large sums by checks or transfers on their books, in the transmission of funds, in the furnishing of a convenient and portable currency, and in the loaning of money to merchants, farmers, and others who have occasion to borrow. *All this is true;* and your committee most heartily concur in the declaration, that as far as banks perform these operations, they merit the support of the public and of the legislature. But it will be recollected, that all these services are rendered to the community, in their capacity of *banks of deposite and discount*, against which objections can scarcely be raised, even by the most cautious, and not in their capacity of *banks of circulation*, the exercise of the power of which, is, as has been before observed, what produces all the evil which banks are capable of creating.

In the second place, it is asserted that banks increase the capital of the community, by the emission of their notes. This position your committee are prepared to show, is in the highest degree erroneous, and entirely at variance with the acknowledged principles of political economy. The capital of a community consists of the capitals, or in other words, of the property, merchandise, products, commodities, coin, and all articles *possessing value*, which belong to all the individuals who compose that community. A mere promise to deliver a given quantity of provisions, clothing, or materials, on demand, is not capital, or otherwise the whole wealth of a nation might be doubled at pleasure, by the mere emission of written promises. Neither is the creation of a *promise* to pay on demand a certain quantity of gold and silver, capital. A bank note, when it is not the actual representative of coin deposited in the vaults of a bank, is in fact nothing but the *credit* of a bank in a visible, negotiable, and convenient form, to which the public are willing to ascribe the properties of money. But it is said, that inasmuch as bank notes are considered as money, their plentiful emission, at least makes money more plenty. Strange as it may appear, even this is but partially true. When notes are first issued to excess, money, as it is called, is plenty *with those to whom it is loaned*, but after the notes are once distributed throughout the channels of circulation, the rise which takes place in the prices of property and commodities *from the depreciation of the money*, is just in proportion to that excess, so that it requires the whole quantity of medium to perform the functions which were before performed by the less quantity. This position may be exemplified thus: if the whole quantity of gold and silver in the world were to be suddenly doubled, it would require *two* dollars to purchase what could be before bought for *one*, and after the prices should become settled upon the new scale, *money* would be no more plenty than it was before. Plenty of money does not so much depend upon the absolute quantity of coin or bank notes which are in possession of the public, as upon the quantity of saleable products and commodities

transferred, and upon the steadiness of demand and regularity of supply, all of which are disturbed by every expansion and contraction of a currency. One million of dollars, when a currency is expanding, may be a plenty of money, whilst two millions, when the currency is contracting, will be a scarcity.

It is, however, further asserted, that banks of circulation afford facilities to borrowers, which could not exist without them. This is admitted to be true, but your committee will attempt to show, that the facilities alluded to, are more injurious than beneficial to the public.

The capital of a society, by which is to be understood, as above mentioned, all its valuable possessions, accumulates by a comparatively slow progression. The annual consumption of a people goes very far to destroy all its annual production, and the surplus which is left is all that can be accumulated. In every thriving community, therefore, it is of essential importance that the greatest possible proportion of its capital should be *productively employed*, that is, devoted to the support of productive laborers, who, by their industry and enterprise, are able to reproduce with profit what they consume in their maintenance. Now it must be evident, under this view of the subject, that it makes a great difference to a community, as regards its prosperity and its capacity to increase in population, whether its capital be loaned with discretion or not. If money be loaned to the industrious, prudent, and frugal citizen, to assist him in extending his agriculture, his manufactures, or his commerce, he will add to the wealth of the nation, by the increased products of his labor, and be able to support himself, replace the borrowed capital with interest, and lay up a fund for himself. On the other hand, if money be loaned to the idle, the unskilful, or the imprudent projector, he may sink it by mismanagement and the want of proper knowledge of his business, or may waste it by improvidence or extravagance. Every dollar thus consumed has a tendency to retard the progress of a society, and to check its population, which must needs ever be limited by *the means of subsistence*. Now, it must be observed, that if there were no banking associations, all the funds belonging to the individuals who compose the mass of stockholders, *would be in the hands of those individuals*, and the very persons who now apply to banks, would be able to borrow of individuals. There would, indeed, be this difference, that those only would be able to borrow, in whose prudent and economical management of their concerns, the lenders had confidence; but instead of borrowing for *sixty days*, they would be enabled to procure money for a year, or for as long a time as they continued to maintain their punctuality, and the confidence of the lender. Your committee would then ask, whether it is not manifest that capital would always be loaned with more judgment and discretion by its individual owners, than by a dozen or more directors of a bank, between whom and the borrower, explanations as to the object of the loan are rarely made. Before the establishment of banks in the interior, the farmer who possessed credit and character, experienced little difficulty in borrowing, on his simple bond, for one or more years, any sum which it was thought could be prudently loaned to him. Embarrassments and failures in those days were scarcely known amongst our husbandmen, and society moved on by a regular, sure, and happy march. In our cities, on the contrary, where loans have been chiefly made by incorporated banks, we have seen a continued succession of bankruptcies, and had it not been for the practice so universally prevalent amongst merchants, of *securing the banks for the sake of endorsers*, banking long since would have been abandoned as an unprofitable trade. It is true, that these objections against the practice of loaning money by boards of directors, many of whom are very little, or not at all, interested in the stock as *bona fide* holders, will apply as well to a bank of discount as to a bank of circulation; but there is this difference between the two, that in the former, a stricter attention would be paid to the responsibility of the borrowers, inasmuch as from the limited extent of its discounts, which cannot exceed its capital, it would have a greater choice amongst the applicants, and from the impossibility of making up its losses from any other source, the interests of the proprietors would compel a more rigid system of caution.

But it may be asked, cannot a bank discount upon its deposites, and loan the money which has been placed there for safe keeping, instead of its notes, without adding to the mass of the currency? We answer in the negative. The right to draw a check upon a bank *payable on demand*, is as much a part of the currency as a bank note. One is just as available for all purposes of money, as the other, and whatever influence the one has in depreciating the currency, is equally possessed by the other; for there can be no difference between a bank note in a man's pocket, and the right of procuring such a note by sending to a bank. Now, where the specific money of depositors has been loaned by a bank, it is clear that the right of the depositors to demand their money, at any moment they please, is still reserved to them. Of course, the amount which stands to their credit on the books of the bank, constitutes a part of the currency, inasmuch as it can be applied to any purpose to which bank notes could be, if drawn out by checks. Your committee are of opinion that the want of a proper understanding on this subject, has caused many of the abuses of banking, and although the amount of the average deposites may be, in some degree, a guide for the limitation of discounts, yet every loan made of deposite money, is, in reality, an indirect loan of the *credit of the bank*.

The third and last position we have to combat, is,

That banks improve the country wherever they arelocated, as is exemplified in the number of turnpike roads, bridges, houses, and barns, which have of late years been constructed.

Had no banks been established in the country, it is reasonable to presume, that the capital of the people would, in seeking employment, have naturally found its way into the most profitable channels. This will usually be the case, when men are suffered to pursue their own interests, without the interference of governments, or the enactment of injudicious laws. Now, if the existence of banks has not diverted capital from its natural course, and given it a new direction, it has merely assisted in doing that which would have been performed without it, and is, therefore, entitled to but little credit. But if, on the other hand, the existence

of banks *has* diverted capital from its most productive pursuit, and wasted or sunk it in such a way as that it is deprived of the power of reproduction, then we say, the system has been most pernicious. Every house that has been built, which was not called for by the increase of population—every barn which has been raised, without being required by the accumulating crops of the farmer—every turnpike road and bridge which has been prematurely constructed, and which does not save to the community, in the reduction of the expenses of transportation, a sum equal to the revenue that could have been derived from the employment of the same funds in other pursuits—are visible monuments of the annihilation of capital. As far as the banking system has been instrumental in these results, and your committee are constrained to say, that in their opinion it is deeply implicated, so far has its tendency been adverse to the public prosperity; and as banks have not the power of producing *the necessaries of life, the real capital which makes turnpike roads*, it would appear that the most they have accomplished, has been, to induce, by false allurements, some unwary people to embarrass themselves by subscribing their capital and credit to unproductive turnpike roads and bridges, and others to lend their money and labor to corporations which can never repay them. Improvements thus forced and extorted, and by no means resulting from the ordinary course of the employment of capital, are not at all to be desired; and when we reflect upon the power of money to accumulate at compound interest, and estimate the difference between a sinking of capital and its profitable employment in some productive industry, we cannot but regret the cause which has been instrumental in producing such a wanton destruction of property. If any confirmation were wanting of the truth of our assertions, it might be found in the fact, that most of our turnpike companies are deeply involved in debt. Much of the amount is due to contractors and laborers, and no small sum to the banks; and it thus appears that they have been in a great degree constructed with the capital of those, who never voluntarily consented to such a permanent investment.

Having thus shown, as your committee conceive, that all the benefits which the community can experience from the existence of banks, are derived from them in their capacity of banks of *deposite* and *discount*, and not in their character of banks of *circulation*, it remains to be shown in what further particulars they are objectionable.

The very nature and essential character of monied institutions are hostile to the spirit of free government. The power and influence which a combination of wealth is capable of begetting, are of so commanding a nature, as scarcely to admit of being controlled. The want of an individual moral responsibility on the part of the persons associated, often destroys all the protection which the public can possibly possess against abuses and oppression. Men have been known, as component members of a corporate body, to acquiesce in measures which would have wholly destroyed their reputation in society, had they given them countenance in private life. Public opinion is the most powerful shield of the citizen against the encroachments of injustice, and whenever individuals are invested with immunities which screen them from the public view, there is danger to be apprehended, as the certain consequence of a divided responsibility.

Your committee are fully of opinion, for the reasons here laid down, that *banks of circulation* occasion much more injury to the community, than they produce of good. Still, however, they are compelled to admit, that, considering the vast amount of debts now due by the public to the banks, it would be highly injudicious in the legislature, to refuse to allow to any of the banks such a number of years after the expiration of their charters, to *collect their debts*, (strictly prohibiting all new loans and issues of notes,) as would render the operation as little oppressive as possible to the great mass of debtors. Three or five years would afford ample time to any *solvent* individual to meet a debt *which he had contracted to pay in sixty days;* and when it is recollected that the capitals of the banks might be directed by law to be divided amongst the stockholders, *after the payment of all their debts*, in instalments of five or ten per cent. as fast as collected, it will be perceived, that the money thus paid to the banks, would be immediately in the hands of the individual stockholders, seeking employment as before. The winding up of a bank is, in itself, a simple process, and by no means accompanied by those awful consequences which interested persons are so apt to depict. If banks have been unfortunate in their operations, let their losses fall upon those who have reaped the profits of their prosperity. Let no artificial rise in the price of their stock, usually resulting from the renewal of a charter, be suffered to deceive the ignorant and unwary into ill-advised speculations, under the delusive hope, that a simple extension of a charter can restore lost capital, or in other words, make *bad* debts *good*.

Your committee are clearly agreed, that in no event should a great proportion of the bank charters which will expire in the year 1825, be renewed. What particular institutions should be selected from the mass, must depend upon the wisdom of future legislatures, who will have a proper regard to locality, stability, public convenience, and the calls of trade. But your committee conceive that it is a duty incumbent upon all such legislatures, to protect the community as far as lies in their power, against the pernicious operations of the banking system, by introducing into *all new charters*, such provisions as will be efficient in restraining them from excessive issues, and from those destructive acts which have hitherto proved so ruinous in their tendency. *A future suspension of specie payments, either through design or misconduct, must be rendered impossible*, and with such a principle wisely and resolutely adhered to by the legislature, the evils resulting from the system will be greatly diminished. Your committee would recommend as absolutely essential to the public welfare, that no charter be granted or renewed without embracing the following provisions, some of which already exist in some of the acts of incorporation:

First. That a penalty of twelve per cent. per annum be imposed upon the amount of all notes and deposites not redeemed or paid on demand, in gold or silver coin; that the charter be forfeited, except for the mere purposes of winding up, and that during any suspension of payment, no dividends shall be made.

Secondly. That no note of a less denomination than five dollars shall be issued.

Thirdly. That no bank shall purchase its own notes, or the notes of any other bank, or receive them in deposite, for a less sum than their par value.

Fourthly. That no bank shall hold any stock or securities of the funded debt of the United States, or its own stock, or the stock of any other incorporated company, except companies incorporated for purposes of internal improvement, *to which they may have subscribed, or shall hereafter subscribe.*

Fifthly. That no director or cashier of a bank, shall be entitled to loans, directly or indirectly, beyond a limited amount, or shall be a member of either branch of the legislature.

* * * * *

[The effects of improper and fraudulent banking, and the flooding the country with an irredeemable paper currency, (*depreciated*, because *not truly* the representative of coin,) have again, for the third time within sixty years, plunged our prosperous young country into embarrassments and losses, not far short of temporary ruin. The present condition of things, (*as yet* at least,) is not quite so bad as it was in 1815; and *that* again, was not so total a bankruptcy, and change of property, as followed the old government paper issues during the war of the revolution. But the present calamities, already incurred, and in almost certain prospect, would probably be considered as equivalent to a full abatement of all the alleged benefits of our always bad system of banking, for the last twenty years, if the same individuals who have secured the past profits, had now to pay the penalties incurred. But this seldom happens; and numerous individuals profit enormously by the maintenance of a system which may ruin as many others, and be more or less injurious to the community in general.

The interests of every class are deeply and injuriously affected by these revulsions, and none to so great extent as the greatest interest of the country—the agricultural interest. Merchants, speculators, and stock-jobbers, may play at the gaming table opened for all adventurers by the banks, and have more or less knowledge of the chances by which they win or lose. But the property of the agricultural class constitutes the greater part of the stakes for which others play, and is risked without the consent or knowledge of the owners. Hundreds of millions were added to the prices of agricultural property by the last transient expansion of bank credits and paper currency—and still more lost by the reaction which necessarily followed. In every sale of agricultural property made during these changes, either the buyer or seller was cheated and robbed by the operation of a system which he did not understand, and could not control. And even in the few cases of individuals who have not bought or sold, they have suffered the evil moral effects of believing their wealth suddenly doubled, and then finding it reduced far below the first low estimate. This part of the effect alone, (which is rarely estimated,) is enough to contaminate and corrupt a whole nation.

We therefore have no reason to apologize for thus referring to this subject generally, (and as a question of political economy, and disconnected with the existing party politics and party contests,) in a journal devoted to the support of agricultural interests. What we proposed by publishing the foregoing report (—which we read and approved when it first appeared, and have never had cause to retract the approval—) is merely what is indicated by the heading above—to give a plain and simple explanation of the three different and quite distinct operations which are confounded and combined in all the banks of the United States—and which serves to show that two of these operations are always beneficial to the public, and that the other alone is always to be suspected, feared, and ought to be closely and securely restrained.

We have chosen to give this report, in preference to any thing of latter date, not only for its clearness, but also because it was first used to suit another and a long past time, and other (though very similar) circumstances—when the present party questions, (with which the subject of banking is now so closely interwoven that they are deemed inseparable,) had not arisen—and when the present political parties, indeed, had not come into existence—and therefore it cannot be charged, as a new production might be, with being designed to subserve or oppose existing interests, or to enter into the arena of party contests—contests which we have long deemed as seldom otherwise than disgraceful and detestable, and never more so than in these times, in which banks and banking have been so mixed with party movements.

Mr. Raguet, the author of the report, has since been distinguished as a writer and controvertist on political economy, and has been eminently serviceable in maintaining the doctrines and principles of *free trade*, which is truly the same thing in effect with the maintenance of the interests of agriculture, and of the southern states. If names and dates were omitted, the statements would pass as descriptive of the present times. But it is easy for the truths of political economy to be so correctly applied, in advance of facts, as to seem to be evidence of the gift of political prophecy. Very many, without such lights, foresaw and could have predicted such disastrous results of expanded paper circulation; but, unluckily for the country, those who gain, or hope to gain, by the expansion, form a different class from those who suffer by the final bursting of the bubble. If they were always the same persons, one such revulsion would be enough to satisfy a nation with the operation of an unlimited paper currency.

Nearly all the restrictions recommended at the close of the foregoing extract, were adopted by the legislature of Pennsylvania; and restrictions very similar (and which were then deemed sufficient to guard against a recurrence of the evil of an irredeemable paper currency,) were also enacted in Virginia. It is needless to add, that all the restrictions yet imposed have been found insufficient.

In addition to these old views of Mr. Raguet's, which are so applicable to the present time, and to all times, we beg leave to present again some old expressions of our own—made on the only other occasion on which

the policy of the banking system of this country came directly under consideration or notice in this journal. We quote the editorial remarks from pp. 618, 619, vol. I. Far. Reg. They were written in March, 1834, during the then existing "money pressure," and were called forth by the remarks of a correspondent in regard to what he deemed the best currency and banking system for the country. Nothing is now changed, except in marking some passages by italics :—

"The foregoing communication treats principally of a subject which is so closely, and to so great an extent, connected with the interests of the whole agricultural community, that we could not, with either justice or propriety, have excluded it from a journal devoted to the promotion and maintenance of those interests. Nevertheless, we would gladly have avoided the necessity of discussing the present "money pressure," because it has been improperly made a party question, and very generally debated upon the ground of one or the other side subserving the views of particular individuals, in their efforts to acquire, or to retain, place and power. But though determined not to permit the Farmers' Register to be connected with party struggles —to become involved in the despicable game which is played by "the madness of the many, for the gain of a few"—still we will not yield our right to discuss any question of political economy, or of general policy, having an important bearing on agricultural interests, merely because political partizans have seized on it, to forward their own interested ends, or those of the leaders whom they slavishly follow, and implicitly obey. If every subject were prohibited, that had been used by others to aid party purposes, it would be necessary for us to abandon the defence of every general and important interest of agriculture as soon as it was assailed: for what measure of government has ever been acted upon, that has not been converted to party uses? Nay, what question *can* be started, that may not be used as a weapon, or a defence, in party warfare?

Our correspondent's expressions are not obnoxious to the charge of being dictated by the feelings or the interests of a partizan. His reasoning and statements are simply those of an experienced and well informed merchant. To the facts derived from his acquaintance with commercial affairs, we pay the utmost respect. But *our* politico-economical views as to the *currency*, have been acquired in a different school—and whether it is from our want of commercial knowledge, or that we are behind the lights of the present day, we remain of the opinion long entertained, that it would be far better if our currency was *principally metallic*. And we would zealously contend for a return to such a currency, *provided* (what we certainly do not believe to be the case now, if it will ever be,) *that there was a sincere disposition on the part of either the people, or their rulers, to establish and adhere to such a rule of general policy*. Whatever may be the immediate cause of the present alarming and general state of distress, the remote and efficient cause is the existence of a paper currency. Without denying the alleged advantages of the system of paper money, and its concomitants, while prosperity and public confidence continue, *it may well be doubted, whether those advantages are not more than counterbalanced, by such effects as are now felt, and such destruction of credit, depreciation of the currency, loss of property to individuals and to the nation, as were suffered in* 1814, *and some years after*."

ED. FAR. REG.]

From the Farmer's Magazine.

BEET ROOT SUGAR IN FRANCE.

The French Ministry is placed in an extraordinary position by the turn which the sugar question has taken. The measure under discussion is pretty nearly the same with that proposed last session by M. Duchatel; but the rapid improvements which have taken place in the domestic manufacture have so far alarmed M. de Laplagne, the new Minister of Finance, as to the safety of an important branch of the revenue, if something more were not done than the mere reduction of one half of the duties on colonial sugar, that he has found it necessary, in the interest of his department, to declare that the new law must contain at least an acknowledgment of the principle that sugar, wherever or however manufactured, is an article eminently suited to the purposes of revenue and taxation. The Minister of Commerce, on the other hand, M. Martin (du Nord,) from the circumstances of his representing in the Chamber one of the departments of France where the culture of beet and the manufacture of sugar have of late been carried on so successfully as to have added in a remarkable degree to the profits of the farmer and the rent-roll of the landed proprietor, finds that his convictions are all on the side of high import duties, to the extent of the *statu quo*, combined with the absence of all fiscal restraint on the development of the domestic manufacture. As the treasury cannot afford to sacrifice the fifty or sixty millions of revenue which it now draws from the article of sugar, and which, in the face of a greatly increased consumption, has fallen off during the last year to the extent of five millions, as compared with 1835, M. de Laplagne is desirous of warning all those who may be preparing to embark in this prosperous branch of industry that they must not expect the continuance of such an amount of protection as even the half of the present duties would afford. Without this salutary warning, he is afraid that his fifty millions may escape from him altogether, and that the sugar interest may find itself in the situation of the Greek philosopher, who resisted his mother's entreaties that he should think of marriage so long, under pretence of his being too young, that he found himself too old before he could be prevailed on. It is probable, however, that the Chamber will content itself for the present session with a sort of *mezzo termine*, in the recognition of the principle suggested by the Minister, and that no attempt will yet be made to levy an excise on the produce of the beet. As to foreign sugar, the new law contains a series of provisions for its admission in a raw state for the purpose of the refiner, on security being found for its subsequent exportation.

This plan of M. Duchatel is, 1st, to protect the colonies, by not allowing beet root sugar to be made and sold without paying a duty. 2nd. To protect the beet root sugar manufacturers by imposing a duty on colonial sugar, so as not to allow the home manufacturers to be ruined by a superabundant supply from abroad. 3rd. To protect the colonists from the evil consequences which would arise from their sugar being taxed too high, or from beet root sugar being taxed too low. 4th. To encourage this new and useful, profitable, and national manufacture of beet root sugar on conditions which shall prevent it from being injurious to vested interests. 5th. To relieve the pressure which weighs down the colonists, in consequence of the heavy duty on sugar, by diminishing that duty, and by equalizing, as near as possible, the duties on colonial and home sugars. 6th. To

take care of the interest of the treasury, which would suffer from the reduction of the duty on colonial sugar, unless counterbalanced by the duty laid on sugar made in France from beet root.

In the course of Wednesday's debate, which was almost exclusively kept up by gentlemen who are either candidates for the office of Minister of Finance, or have already enjoyed that distinction, some allusion was made by M. Passy to a recent improvement in the manufacture of sugar from beet root, by which no less than 10 per cent. has been obtained on the weight of the root, instead of something like 1 per cent., which has hitherto been the average product. Two companies, the one in Baden, the other in Wirtemberg, have been formed under the patronage of the two governments, and provided with sufficient capital for carrying the new system of M. Schuzembach into effect; and as its efficacy has been proved by experiments on a large scale, performed in the course of the present season, it can scarcely be doubted that slave-made sugar is destined, in a very few years, to be driven out of the market by the cheaper and better produce of free labor. Besides, by the system of M. Schuzembach a much greater portion of the work than heretofore can be executed by machinery; thus affording another guarantee in favor of the interests of humanity, although it may possibly take the business out of the hands of the small farmer to throw into those of the landed proprietor in the shape of rent, and of the monied interest in the form of profits on capital.

GOVERNMENTAL ACTION IN AID OF AGRICULTURAL IMPROVEMENT IN THIS COUNTRY.

We have already heard of expressions of approbation, and even delight, from intelligent persons who have seen Washington's correspondence for the first time, in our late republication. If there were nothing else therein to interest the agriculturist, there would be enough to make the work highly valuable in the evidences it affords, in addition to all belonging to his public services, of the great and solid worth of Washington's character. These letters were evidently designed to be *private*; they are not only free from every appearance of display, but they are full of marks of haste, and even of gross inaccuracies of style. But still, there is not a page that does not help to increase our admiration of the writer's sound, practical and useful wisdom; and the whole serves to heighten any previous *just* appreciation of his worth, mental and moral, founded upon his historical and public character alone. Compare these private thoughts, and the private life and labors of Washington with those of the *great men* of modern times, who have striven or are now striving to obtain and hold the rank and power which he was so anxious to resign—and how immeasurably superior will his worth appear!

The latter part of the correspondence, given in the first pages of this No. shows how highly Washington prized the operations of the British Board of Agriculture, and how anxious he was that similar works should be effected in this country, under patronage of the federal governmeut. The now every-day objection of "unconstitutionality" had not then been thought of, either in this case, or in the many others to which that objection has been successively urged, to be trampled under foot by those who urged it, whenever it stood in the way of their interest, or cherished objects. But as no political leader can forward his ambitious views by aiding agricultural improvement, and no mercenary camp-followers can make much by any jobs it would furnish, there is no doubt but it will remain the undoubted construction of the federal constitution, that the government has no right to aid agriculture by any general and useful system of encouragement. Nor would we (being of the "straitest sect,") wish this single case of strict construction to be overthrown or assailed, even to gain the greatest boon it might insure to agriculture. But we would most earnestly recommend this subject, sustained by Washington's decided approval, to the state legislatures, where no constitutional objections oppose full and beneficial action. In Virginia, Washington's own birth-place and home, we believe any such early action is now utterly hopeless. The legislature would spend $100,000, in debating empty and worthless abstract resolutions, tending to no practical or useful result whatever, or in legislating for the indemnity and perfect security of broken banks for any violations of their chartered obligations, with less grudging, than give the hundredth part as much money to spread agricultural knowledge, in any manner, or with the best prospect of success.

The legislature of New York has appropriated large sums, and during many years, in aid of agricultural improvement, and with undoubted good and *profitable* effects. The legislature of Massachusetts, at the last session, adopted a still more commendable and yet cheaper means for the same aid, in directing a general agricultural survey of that state. Even the barren and poor state of Maine gave more, last session, in a bounty for raising wheat, than would serve for 20 years of liberal and proper appropriation for the spreading of agricultual knowledge in the great and rich state of Virginia. And though we disapproved of the mode and direction of that bounty, we cannot but applaud the spirit which induced the offer, and hope for better reward for it than we anticipated and predicted. North Carolina has appropriated $200,000 for draining the immense swamps possessed by that commonwealth; a liberal and noble expenditure indeed—and which, *if judiciously directed*, will be returned doubled, or perhaps quadrupled in value, to the state. These are subjects for congratulation for every friend to agriculture, even though there still be no green spot on which to rest the eye, in the wide field of Virginian legislation on agricultural interests.

It may be stated, in denial of our previous remarks, that the Congress of the United States has, on several occasions, aided agriculture, by ordering and paying for the publication of treatises on agriculture, for extensive gratuitous distribution. This is true; but it is believed that these measures were adopted, or suffered to pass, merely as a few of the numerous *jobs* authorized for the benefit of private individuals, and certainly not upon the ground of forming parts of a deliberately designed plan of aiding and extending agricul-

tural improvement and knowledge. And as little benefit has resulted from these publications as might be expected from the motives supposed. Without discussing the right or the propriety of any such action of Congress, it may be granted that the publication and wide circulation of sound and wanted instruction would be one of the most efficient as well as the cheapest possible modes of aiding agricultural improvement. But it would seem that the national legislature, while willingly incurring all the requisite expense, always takes especial care that it shall do no good. It seems that to be fitted to write or digest a treatise or report on any agricultural subject, by order of congress, an indispensible qualification for the writer or compiler is to be totally unacquainted (practically at least,) with the the subject to be treated. Thus, the first order of the kind, the preparation for publication of a 'Manual of Silk Culture,' was entrusted to a literary and professional gentlemen of a great northern city, who was totally without knowledge on the subject, except such as he or any other well educated man could afterwards compile from books—and who, moreover, was notoriously deficient in the useful application of practical knowledge, on almost every subject. A similar treatise on the culture of the sugar cane, and manufacture of its products, was afterwards ordered, and its preparation confided to a distinguished professor of a northern college, whose scientific and literary attainments we hold in very high estimation, and would be among the last to detract from, but who was fitted for this particular work by having no practical or particular acquaintance with any part of the subject, and who, most probably, had never in his life seen a growing sugar cane, or a sugar mill. The voluminous report on the production and trade of cotton, though less agricultural in its character, than commercial and statistical, was also enough connected with agriculture to require some knowledge of the culture—and therefore it was required of a member of the cabinet from New Hampshire. If there are any exceptions to be found in other cases, we are ignorant of them; and therefore think that our inference is fairly made, that whenever the government of the United States orders the preparation of an agricultural treatise for publication, that *almost total ignorance of the subject* has been invariably one of the qualifications of the writer selected.

From the Southern Agriculturist.

OBSERVATIONS IN REPLY TO AN "UPPER COUNTRY RECLUSE," WITH AN ACCOUNT OF AN EXTRAORDINARY PRODUCTION OF GRAPES AND WINE.

To the Editor of the Southern Agriculturist.

Columbia, S. C. Sept. 9th, 1837.

Dear sir—You guessed rightly when you supposed I should be inclined to make a few observations on the communication of an "Upper Country Recluse," in one of your last numbers. I was so inclined, and would have done so at the time, had I not been prevented by indisposition.

The errors of the "Upper Country Recluse" were but few; for one of them—the leaving only one leading shoot for the purpose of gaining height as soon as possible—I do not look upon as an error, although two would have been safer; but this shoot should have been secured beyond the possibility of its being destroyed. It is generally better, however, before a vine is much extended, to wait till it is three or four years old, keeping as much of the growth, the first and second year, as is practicable. The effect of this is to strengthen the roots and enable them thereafter to assist the efforts of the cultivators in extending the vine either vertically or horizontally, according to his plan. This gentleman, I suspect, does not remember clearly what he has read on the subject, when he says, "I had read that each eye would produce me a bunch of grapes," &c., or I misunderstand his meaning. Each eye or bud left at the winter pruning, produces one shoot, and each shoot, two, three, and even four bunches of grapes. As to the fear of a vine's bearing more grapes than necessary, or that it can bring to perfection, I look upon this as Nature's business, and never interfere with it, except in making experiments, in which I never have found that the suppressing a part of the bunches of grapes either as soon as they appear or afterwards, was attended with any benefit.

I must say that I come to a different conclusion from that of the 'Recluse,' as to Nature's object in giving great luxuriance to the vines. It appears to me that she intends thereby to form large plants of them, and that the business of the cultivator is to direct Nature's operations towards the attaining of his own views; but without a direct opposition to her efforts. Young vines, in a thrifty condition, grow with astonishing luxuriance, particularly from the age of five or six years to ten or twelve. I have frequently seen, during this period, shoots that would extend thirty or forty feet in length, with a proportionate thickness. I think it more prudent, at the winter pruning, to leave such shoots several feet long, so as not to oppose Nature's evident object too violently, and I think I never had cause to repent my pursait of this plan.

As to *pinching* off, or cutting off the shoots, I must say a few words. I must begin by making the necessary distinction between the main ones, from those usually called "side-shoots," "suckers," "gourmands," and "robbers." As they grow in the axils of the leaves, between the stem and the leaf, I have adopted Bosc's name (*entre feuilles*) for them, and call them "interleaves." These, all writers on the subject recommend to be *pinched off* as soon as they appear; but the practice of most cultivators is somewhat different, for many of them only break them off, when they have attained a considerable length, and then leave one or two leaves on them. On vines growing most luxuriantly, this last may be the better practice; for I have sometimes observed that the suppressing them altogether, on very vigorous shoots, has caused the bud, which they seem intended to protect, to grow and bear fruit. This effect is almost always produced by shortening the long bearing shoots, which is a very bad practice, and which I suspect had been the case with the vines which the Recluse mentions thus: "Guess my surprise, Mr. Editor, on now observing, as the fruit came out, that instead of a bnnch of grapes at each eye, a new fruit stem put out there, on which there were sometimes three, sometimes four, and I verily believe sometimes five

bunches." I may have misunderstood the writer; but this is exactly the effect of shortening the bearing or other vigorous shoots, by which means, a second crop of grapes is obtained, which, however, seldom come to perfect maturity. In order to perceive the nature of the injury done by this operation, we must keep in mind that the buds that are at the junction of the leaves with the stem, are those intended by Nature to produce the following growth of bearing shoots. If you force them to push by cutting off the end of the shoot, there will be no bud left for the following year's crop, and the vine will thereby be materially injured. This shows also the impropriety of pulling off the leaves, as inexperienced people recommend; for the leaves protect and support the bud at the foot of them, and by breaking or cutting them off, you deprive these buds, which are intended for the following year's growth, of the nourishment necessary to enable them to perform their intended functions.

I think 12 feet is inconveniently high for an arbor for vines, and find eight, or eight and a half feet much more convenient, and sufficiently high to allow a free circulation of air below, particularly as I do not suffer any of the grown vines to have any thing growing below the top of the arbor, which is level on the top, and on which the vines are made to spread evenly, and are tied down.

Mr. Recluse's precaution of locking his garden gate and keeping the key in his pocket, is very good. I hope that, to coincide with this, his fence is sufficiently high to keep off all two-footed thieves, except those that can fly. As for his having neglected to have his frame made at first full and complete, I consider it not as an error; for the vines do not need it for two or three years, and sometimes a longer time, during which, they may be supported by poles. My practice is to put three poles to each strong vine, sinking them in the ground at some distance from the vine, forming thereby a triangle in the middle of which is the vines. These poles are strongly tied together at the top with a willow twig, and the wind cannot blow them down. These will last about three years, and when the frame or arbor is made, three years of its duration is gained.

* * * *

I have thus, sir, candidly and fully given you my views of the 'Upper Country Recluse,' for his benefit, and that of others, if any such a thing can be gleaned from this letter of mine. I take the liberty of exhorting him and all others, to persevere in this most interesting culture, and assure them that my experience proves to me that it is as wholesome an exercise for the body, as it is most pleasantly exciting to the mind. I am at this very moment under the influence of these very benefits, for I have been for two weeks past busily cutting my grapes, and making wine, both at my farm and in my garden. I was much indisposed when I began, and would most probably have got sick, but for the great exertions and fatigue I unavoidably put upon myself, I had no time to think of sickness. In consequence of this I have much improved in health.

Do pray, my dear sir, recommend my remedy to all the good people of the low country, particularly to those who are in the practice of spending their summers at the north among the abolitionists, with whom they leave all the money they can spare, and sometimes even a little more. Send them up the country to establish vineyards, and gain strength, vigor, and health, together with wine, which they may warrant to be genuine. By way of encouragement, I must tell you that I have this very day terminated my vintage, except a few odd grapes, which I shall gather next week, which will add 50 or 60 gallons of wine to that already made. I made at my farm 750 gallons, and in my garden 528 gallons. This last is a most enormous crop; for the vines that produced that quantity are on one sixth part of an acre. This is, therefore, at the rate of 3168 gallons to the acre, which is perhaps a greater crop than ever was made any where; at least, I never have seen any account of any one more than 2000 gallons, and that is exceeding rare. I have, moreover, reasons to believe that the wine will be of a very good quality. The produce of two of the vines in my garden is so great, that if I had not the most respectable witnesses of the fact I should hesitate to name it. They produced 130 gallons of wine, and even more. After this, and my paper being full, I have only to assure you that I am, very respectfully, sir,

Your obed't setv't.

N. HERBEMONT.

From Stephens' Irrigator and Drainer.

STRAIGHTENING WATER-COURSES, PROTECTING RIVER BANKS, AND BANKING HAUGH LANDS [OR LOW-GROUNDS.]

This is a subject of the greatest importance and of the highest interest to landed proprietors.

The natural licence of mountainous streams is not only destructive to landed property, but frequently to lands of the best quality; and is often the cause of disputes, and not unfrequently of legal contentions between neighboring proprietors.

A river is the most unfortunate boundary line of an estate, unless where the water is unfordable; but a river or a rapid stream which is liable to high floods is continually making devastations.

Yet this subject, so important and interesting to landholders in general, has had less attention paid to it, and is certainly less understood than any other branch of equal importance within the circle of rural economy. It has never, I believe, been treated of in detail as a distinct subject as it ought to have been; and in practice, I have too generally found it in the hands of men who have not paid that attention to it which they ought to have done, or have left it to ignorant workmen, whose aim, for the most part, is to get through the work in the easiest way, without considering the consequences.

The great mischief which is constantly going on, and the very expensive attempts that are ineffectually made to apply a remedy, are equally to be lamented.*

* To prove this assertion, I could produce several instances which have come within my knowledge within these few years, but need only mention two. The one happened in draining some bogs near Peebles, where a considerable sum of money was thrown away on account of one rivulet being carried into another at right angles, instead of being carried obliquely into it further down the stream, which every engineer acquainted with the impetuosity of mountain streams would have done.

In all mountainous districts of this island, the haugh lands are peculiarly liable to the ravages of floods. They have evidently been formed by strong currents, and the alluvial deposites of water in a state of extreme agitation. They are generally composed of soil, gravel, sand, and stones of considerable size. In many instances, these substances are deposited pretty regularly, according to their several specific gravities.

The surface, however, is often covered with earthy matter, deposited by the overflowing of water since their formation, the soil in many instances being very deep and of the most valuable description.

Through these valleys the rivers are found to flow in devious courses. In some instances they are confined in deep channels, whose banks they seldom overflow; but more frequently their channels are very shallow, little below the general surface of the lands they pass through. Hence, in high floods, their immediate banks are generally the victims of their rage.

There are instances in almost every valley, but more especially where they are much contracted, of the torrents rushing out of their confined channels into flat haughs, and ravaging several acres of the best land in a single flood.

I hope the following short treatise will be found serviceable, and be the means of preventing those land-owners whose properties are situated on the banks of rivers from allowing their most valuable alluvial soil to be washed away, when, most likely, if a few pounds had been judiciously applied in time, it would not only have saved the lands on the one side of the river, but would have protected those on the other side at the same time.

To simplify the subject, I have divided it into three branches: first, straightening water-courses; secondly, protecting river banks; and, thirdly, embanking haugh and other lands.

Straightening water-courses.

The difficulties and expense attending the alteration of the course of a river, depend on the particular circumstances belonging to it.

If the river is the boundary line between the properties of different proprietors, the first step is to obtain the whole of the proprietors' consent to the alteration. Secondly, it must be considered whether the ground will admit of the proposed line to be straight, or whether it will be necessary to make one or more bends in it, so as to divide the land equally between the different owners, without being under the necessity of transferring small portions of land from the one to the other, which, in general, is very troublesome, especially where the lands are entailed, in which case it often prevents improvements of the greatest consequence. Thirdly, in a water-course where mills occur, and the fall of the water is not more than from four to six feet in a mile, the dams that are erected across it for supplying the mills with water are, in many instances, of the greatest injury to the improvement of the adjacent lands. This is the case with many of the water-courses in this country; there are even cases where the mills have not only a dam for throwing the water into the mill-lead, but have other dams farther up the river, for collecting water in droughty seasons in the bed of the river, so that the miller can let it down to the mill at his pleasure. These dams are more injurious to the country than people are in general aware of. In many instances they completely prevent all draining of the surrounding lands.* I know cases where the proprietors are so blind to their own interest, that, for the sake of a paltry mill, only worth from £40 to £60 per annum, they allow land to be destroyed that would yield ten times the amount of that sum yearly.

It is certainly the interest of every land-owner to make the most of his property, in such a way as he may find most suitable to his circumstances. Therefore, in cases where a mill-dam cannot be avoided, and it is necessary to straighten and deepen the water-course as a preparative to other improvements, the engineer has only one choice, and that is, to form an embankment on each side of the river, as far up as the water is thrown back, and high enough to free the site of improvement from being overflowed at the highest floods; and by means of back drains, and, in some cases, an aqueduct laid under the bed of the river to communicate with the drains, the whole of the land (although lying under the level of the water in the mill-lead) might be drained, by carrying the outlet drain into the river below the mill-dam.†

In such cases, it is true, the expense becomes higher, but not so very dear if the site of improvement be extensive, for the whole expense will be repaid in two or three years.

In vale districts, and other low land situations, the currents of rivers are generally sluggish. There the cutting of the new channel is merely the work of manual labor, being attended with no other difficulty than what may arise from the expense, which will depend on the size of the river, the nature of the ground to be cut through, and the value of the labor in the given district. This is generally to be ascertained with sufficient accuracy by previous calculations.

It is to be observed, that the size of the new cut depends on several circumstances; such as the extent of country it is to drain, whether a flat or mountainous district, and particularly the natural fall of the district the river runs through. One great mistake which is often committed in straight-

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The other instance was in straightening the Lyne river, immediately below the village of West Linton. A laboring man was both engineer and contractor for the work, which was executed according to his plan, with stone walls built on each side of the new cut, and banks raised half-way up the walls, to prevent the water at high floods from finding its way through them into the haughs; but, alas! the first flood swept nearly the whole before it, for the dimensions of the new cut were only half of what it ought to have been.

* For example, the North and South Medwins in Lanarkshire. In the former of these rivers, dams of both descriptions are to be found, and, in the latter, a dam exists which prevents the draining of several hundred acres. The mill, with sixty acres of land, is let for £60 per annum; the mill, without the land, would not let for £10 per annum. Since the publication of the last edition, the South Medwin has been straightened and made deeper, whereby a sufficient fall for the drainage of five hundred acres has been gained.

† An operation of this kind has been executed by me at Dalquharran, the property of T. F Kennedy, Esq., where the river Girvan has been straightened and embanked, and the outlet drain carrried by a tunnel under the flower garden into the river below the mill dam

Fig. 1. *Horizontal plan.*

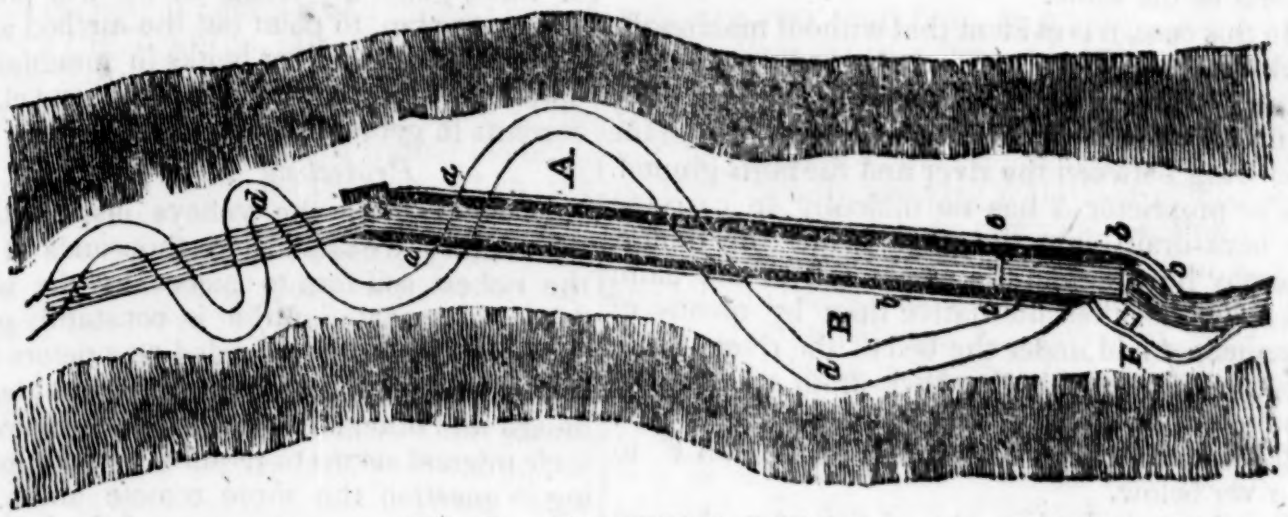
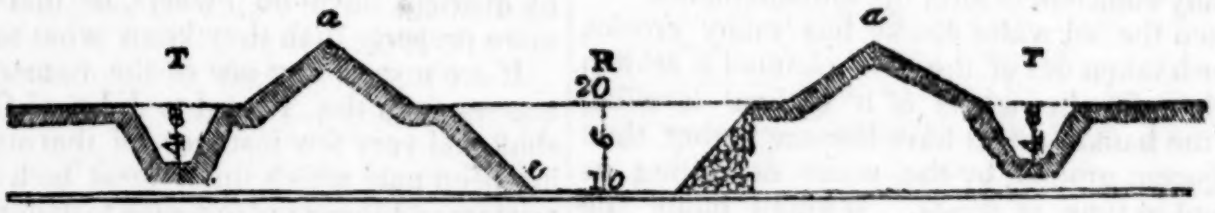


Fig. 2. *Perpendicular section.*



ening water-courses is, in not giving the new channel sufficient dimensions, whereby the water is forced over its banks into its former course; and in not giving the sides sufficient slope, whereby the banks are undermined—large pieces tumble down and occupy a portion of the bed of the river, whereby a current is excited between it and the bank, which, in a very short time, widens the breach and forms a new channel.

To give particular directions for forming the slopes of river banks, depends on the nature of the soil it goes through; however, I have generally found from one and a half to two feet on each side, for every foot in depth, to be sufficient. I have always found the greater the slope the better; and for want of this precaution, many a valuable undertaking has been completely destroyed.

We even find, where some little attention has been paid, the method used to obviate the evil has been more injurious to the preservation of the banks than of service, for instead of smoothing the inequalities of the banks to let the water pass with the least friction, we often find a quantity of stakes driven into the sides of the river with their heads several feet above the surface of the lowest water-mark; the consequence is, at floods they collect weeds, sticks, &c., whereby the water is penned up, thereby making a fall, which scoops out a hole in the side of the slope immediately below, and, in many instances, forms a current between the stakes and the solid bank, which, in a few floods, has so widened itself, that we often see the remains of the stakes standing in the middle of the bed of the river. It is true, there are cases where stakes are unavoidable, either from the softness of the bottom or want of other materials; but, in such cases, the greatest care should be taken to drive their heads down to the level of the lowest water-mark.

In soft soils, after having given the sides of a new water-channel the desired slope, I have generally found (if the operations have been done early in the spring) a covering of good turf to be one of the best protections against the agitation of water, especially if the turf has been taken from a place abounding with rushes, and gets time to grow together before the floods come—it is then almost impregnable.

In particular parts, as at sharp bends, where ordinary sward or pasturable turf is not able to prevent the current from breaking up the soil, the whole angle of the slope should be removed, and the space filled with small stones. (See fig. 2.) In situations where stones cannot be procured, ribgrass and the butterbur (*tussilago petasites*) are singularly well adapted for the protection of river banks. On examining into Nature's practice in protecting the sides of river banks, we find it carried on with the best effects by those plants. When they gain possession of a river bank, barely above the level of low water, and, of course, exposed to every rise and fall of the water, it becomes, in many instances, at least, as securely sheltered from the effects of the current as if it were cased with stone. They appear to be singularly proper to be cultivated on the lower margins of grassy slopes—a situation in which they seem to delight.

To illustrate this subject, let us suppose the river *d d* (fig. 1.) to be the boundary line between the proprietors A and B, and the land and mill F belonging to a third proprietor, who has a privilege to a dam across the river *F f b*. A and B are desirous to improve the boggy land lying between the rising ground and the river; but before that can be conveniently done, it will be necessary to straighten the water-course from the mill-dam *f* to *h*, a distance of a mile.

In straightening the river so as tomake the new channel the boundary line between the properties, a small bend will be required at *g;* and as the fall from *g* to the top of the mill-dam *f* is only four feet, it is evident that the descent is insufficient for draining the ground without the assistance of embankments on each side of the river to protect the adjacent land from the injurious effects of unrestrained floods. The fall from the bend *g* being only four feet, and the water at high floods being known to rise nearly the same height above

the dam, it is obvious that the height of the banks should be the same.

In this case, it is evident that without making the back-drains *a a b*, immediately behind the embankments, neither A nor B will have an outlet to carry away the water collected in the greater part of the land lying between the river and the high ground.

The proprietor A has no difficulty in carrying the back-drain into the river below the dam *c*, whereby he will gain the whole fall of the dam; but B has no other alternative than by means of an aqueduct laid under the bed of the river at *e e* to communicate with the back-drain *a b*, for the situation of B is such, that it is impossible to carry the water through the ground of the mill F to the river below.

As all the stuff taken out of the new channel has been previously deposited in the old water-course, the stuff taken out of the back drains is generally sufficient to form the embankments.

When the old water-course has many crooks, the earth taken out of the new channel is seldom enough to fill the whole of it without levelling down the banks, which have become higher than the adjacent ground, by the water depositing its sediment in time of floods. Without filling the old water-channel, the proprietors cannot derive the advantage from the undertaking they otherwise would; therefore, in operations of this nature, I have always found it advisable to finish the whole before the men leave the spot, otherwise it too often happens (especially when the filling up is left to the discretion of a tenant) that this part of the work is finished in a very slight manner, which is not only a considerable loss to the occupiers of the land, but throws discredit on all the parties concerned.

By shortening the length as well as straightening the course of the river, the force of the current at the bend *g* will be considerably increased, and the lands in that part will be thereby endangered; therefore every precaution should be taken in securing the slope, for should it once break, it will not only injure the lands of A, but, in a very short time, a bay will be scooped out a little below on the opposite lands of B, and, in the course of a few years, the river will gain its original serpentine form. However, although every precaution has been used by the engineer, breaches will occur for one or two years, (especially if the bottom be gravelly,) or until the bottom and sides become, as it were, puddled by the action of the water.

If the subject of improvement be of magnitude, it is generally prudent to contract with a responsible person for the entire execution, a conditional clause being inserted in the contract, binding the undertaking party to uphold the works during a specified number of years after being completed. For the want of these precautions, large sums of money are often thrown away.

Having shown the method and necessity of straightening water-courses in situations where the soil for the most part is deep, and the descent of water generally sluggish, we will proceed, on the same plan, to point out the method and necessity of protecting river banks in mountainous situations, where the soil is mostly gravel, and the currents in general rapid.

Protecting River Banks.

If we examine the valleys dispersed through this country, we shall find thousands of acres of the richest soil torn to pieces by the impetuous floods—a devastation that is constantly going on, for there are very few landed proprietors who pay that attention to the ravages committed on the haugh and other lands near their residences which their interest seems to require, without once calling in question the more remote lands. And if we make an impartial survey of the havoc that is constantly going on, we shall hardly ever find a water-course but we shall be apt to think that many districts have no owners, or that they have more property than they know what to do with.

If we inspect any one of the numerous water-courses from the Tweed to John o' Groat's, we shall find very few instances of that attention having been paid which the interest both of the proprietors and the country seems to demand. In the few attempts that have been made to remedy this evil, we find most of them doing more injury than any permanent good.

The most extensive operations of this kind, and, at the same time, carried on in a systematic manner, are on the banks of the rivers Tay and Earn. The banks of these rivers being very much exposed to the rapid rise and fall of the water, which mostly runs in a gravelly bed, the ravages committed by the currents are often very alarming, so as to have caused some of the proprietors to pay more attention to protecting them than is found in most other districts.

His Grace the Duke of Athol and the Right Honorable Lord Willoughby de Eresby, in particular, have expended considerable sums of money in protecting different portions of the banks of the above-mentioned rivers, by means of sheathing the affected places with small stones—experience having shown that to employ any other method would be ineffectual.

Those operations, with a few others on the Earn and Almond, are perhaps the most permanent in the country.

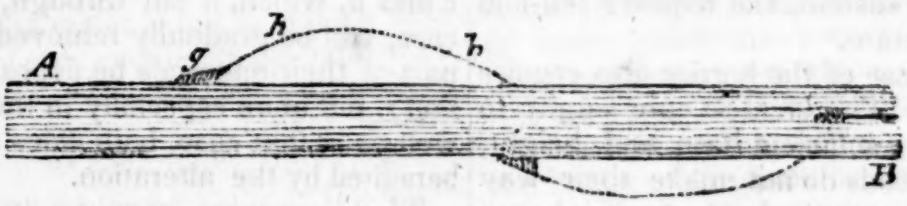
The means generally employed by people not acquainted with the currents of water for protecting river banks are, for the most part, piers or jutments, run out at right angles into the beds of the rivers, which, in most cases, increase the evil instead of remedying it. Another method is by driving long stakes into the affected part of the banks, as mentioned above in page 433, which is equally if not more injurious than jetties. I know instances where an ill-directed jetty or an ill-judged piling has caused the river to take a contrary direction from what was intended.

Fig. 3.

To guard against these mistakes, it is to be considered that the path is to be cleared as well as to be made evident and safe to be pursued; therefore, to simplify the subject and endeavor to render it

plain, let us suppose the current of a straight part of the river *a a* (fig. 3.) to be interrupted by a large stone, or the root of a tree brought down and lodged by a flood at *b*. This, in rivers in general, is the cause of mischief. Through this trifling incident, the current loses its direct course; for when the flood falls to the level of the obstruction, the water becomes confined in that part, its height above the obstruction is consequently increased, and its current opposite and below it not only accelerated, but gently turned from its direct course towards the opposite bank of its natural channel, which, if it be of an earthy matter, becomes undermined, and the upper part of the bank falls down, and is carried away by succeeding floods. What tends to increase the evil, is the channel immediately below the obstruction, as at *c*, becoming occupied, in minor floods, with comparatively stagnant water. It is, in consequence, filled up with sediment there deposited, whereby an additional weight of water is thrown on the opposite bank, which, if the increasing cause of mischief be not soon removed, will, in a very short time, be greatly torn away; and, in a few years, a bend at *d* will be scooped out in the grounds of the proprietor A, with a corresponding bank of sand, united with and becoming the property of the proprietor B. If the lands of B are equally valuable with those of his opposite neighbor, he has no reason for exulting in his increase of territory; for while the current is leaving him, perhaps, a worthless sand-bank at *c*, it is scooping out a bay at *e*, and giving to his neighbor an increasing territory at *f*: thus a mutual loss of lands is incurred; and the evil is constantly increasing, until the banks are protected, or the current is restrained, and directed into its original channel. In this view of the subject, it is evident that there are several remedies for the evil. The one is to sheath the sides of the injured banks of the bays *d* and *e* with stones until they form a slope of forty-five degrees, which will resist the circuitous current; and the river should be allowed to remain in its crooked state. This is the most permanent of all remedies; and where stones are

Fig. 4.



plentiful, it ought never to be neglected. Another is, to erect a pier or jetty, as at the point *g* in figure 4, to ward off the force of the current from the bank *d*, and direct it straight, with the intention of preventing more mischief, and bringing back the course of the river to its original straightness. The diverting of the current may frequently be accomplished at a comparatively small expense, and its effects be rendered permanent; for it is plain, that if the accidental obstruction mentioned had been timely removed, no bad effect would have ensued, as the river would have continued its direct current. In many cases, by timely and judiciously placing in a similar manner an obstruction proportioned to the magnitude of the power to be counteracted, the like effect might be produced.

Thus, if in the case supposed, the river-guide above mentioned were to be erected by the proprietor A, and to be inclined towards the stream in a degree proportioned to the rapidity of the current, not only the banks *h h* would be defended, in a great degree, from the action of the water, but the sand bed *c* (figure 3) would be carried away, and its materials deposited in the bay *d*, and thus, in a twofold way, be refilled and brought back to its original state.

And further, if, when the gravel bank *c* is removed, the proprietor B were to erect a similar barrier at the point *i*, the sand bank *f* would, in like manner, be carried off, the bay *c* be returned to its former proprietor, and the straight course of the river be nearly regained, when the barrier ought to be removed, whether belonging to one or more proprietors, they all having a general interest in directing the river which separates their properties into a straight course, or keeping it in its natural channel.

In protecting river sides, there are certain principles and particulars of practice to be observed. The position of the barrier should be such as to produce the desired effect, with the least possible resistance; for the current of a river, as the waves of the sea, should be subdued by stratagem rather than by force—resistance serves only to increase their fury. A wave falling on a flat shore seems to die without a struggle, while one that is stemmed by an abrupt rock or bank, strikes with tenfold force and breaks in pieces. In like manner, a rapid river will glide smoothly along the sides of an even bank, though it may somewhat deviate from the direct course, without perceptibly disturbing the current or injuring the banks that direct it, even though they are merely of turf; but when a strong current meets with an abrupt projecting or sharp bend in its channel, its fury is increased, and stones are sometimes hardly sufficient to resist its force. Hence, in erecting a barrier with this intention, it should always be made to unite evenly with the natural bank of the river, with a smooth hollow curve, that the fall of the current may not be checked. The outer or lower end of the barrier should be directed in a line with the straight part of the bank below the bay, which, in most cases, if carried far enough down the river, prevents the stream from doubling the end, and falling back into the bay; for, in cases of this nature, the current of a flood and that of low water take different courses, according to their different heights and strength. The one rushes forward in the line required, and the other, unable to surmount the obstruction for want of strength, at the point of the barrier, doubles it, and falls back into the bay with an accelerated current, directed, perhaps, straight to the injured bank, which may thus increase, instead of preventing the injury. To remedy this bad effect, and to guide the current at all seasons into the same channel, it is sometimes necessary, where it can be conveniently done, to cut a channel, through the obstructing sand-bank, deep enough to admit the stream at low water. By this procedure, although the bay *d* should not be so completely filled up, yet the advantage of putting

an immediate stop to the ravages both of floods and low water, might counterbalance that defect.

But, in most hilly districts, the currents are very rapid, and, consequently, the sand-beds are so frequently renewed by the action of the water, that, in many instances, it is extremely difficult and dangerous to meddle with them. And unless the site of improvement be of such a magnitude that it will allow the new channel through the sand-bed to be large and deep enough to contain the largest flood without rising over its banks, it should never be meddled with. The strength required depends on the weight of water, the force of the current, and the angle of deviation from the given direction of the current immediately above. If the required direction of the barrier be nearly the same as that of the current above it, as in the last diagram, it has little more than the weight of the water to withstand; whereas a jutment run out abruptly into the natural course of the current, as is commonly done, has not only the weight but the force of the water to sustain, and requires ten-fold the strength of structure.

The height and base of the barrier also require particular attention. The greatest care ought to be taken in giving it a sufficient base and height, so that the highest floods do not make their way over the top contiguous to the bank; for if it be not raised high enough to prevent the water of floods from making its way over it, not only the foundation may be endangered, but a large hole might be scooped out behind, especially in a place where the general fall of the river is considerable; so that, instead of protecting the injured part, more damage would be done.

The materials of a river-guide ought to be suited to its occasion. Where stones can be procured, they make the most permanent defence; but in districts where they cannot be got but at an immense expense, brushwood and whins wattled together with short stakes make a tolerable substitute. In most hilly districts large rough stones are plentiful. A long pile of loose stones laid flatly, sloping against the bank of the river, or a flat ridge run out from it, may form a cheap and durable barrier; for should they be disturbed by an extraordinary flood, they may be readily replaced when the water subsides.

It may be proper to notice another case in which a barrier, or river-guide, may be employed with good advantage, namely, where a stream of the above description falls down a crooked valley, and necessarily takes, at certain points, a winding course, as in figure 5.

If the quantity of water is considerable, its fall rapid, and especially if it is conducted to the bend, as at *a*, down a straight unobstructed reach, scarcely anything but substantial mason-work can resist its force in that part.

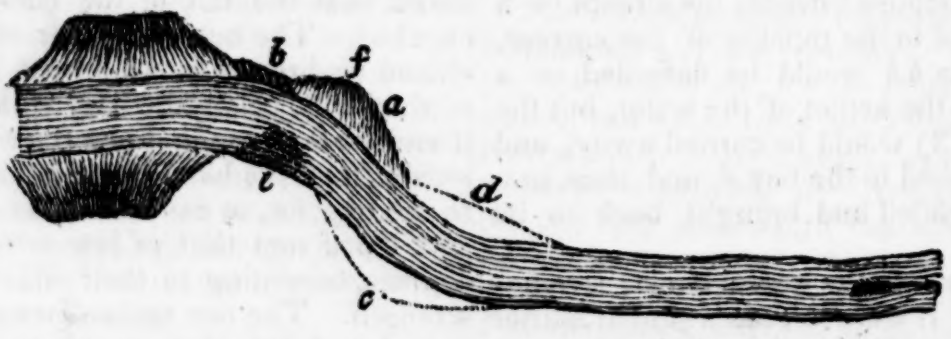
In situations of this sort, it is not uncommon to see earth banks scooped out and undermined, until a perpendicular precipice of twenty or thirty feet high be formed.

But if a barrier be erected at *b*, with an easy curve from the natural course above, *so as to bend the current without breaking it*, and direct it into its natural channel in the valley below, it will have nothing to contend with but the loose gravel-beds *c* and *d*, which, if cut through, as in the former case, will be gradually removed, and the principal part of their materials be deposited in the bays *e* and *f*, but more especially in the latter; in this as well as in that case, both sides of the river will be benefited by the alteration.

There are cases, however, in which nothing but sheathing the whole of the injured part can be properly used to prevent further depredations; as, first, where the river runs through a valley whose substratum is mostly gravel, as it frequently is in mountainous districts; and, secondly, where a deep pool of water occurs in any part which may require to be bent and protected to an unalterable channel. In such cases, it is extremely difficult to get a proper foundation for a barrier. In hilly situations stones are generally plentiful, and they ought to be applied in such a way as the given case may require.

If the foot of the injured bank be covered with a pool at low water, shelve off the brink of the bank, and pour down loose stones from the top of it, suffering them to form their own slope in the action of falling, continuing to pour them down until the whole space of the injured side of the river form a slope of forty-five degrees.

Fig. 5.



But where a built barrier cannot be avoided, as at *b* in figure 5, the foundation ought to be laid pretty deep, to guard against any accidental scooping of the floods. The wall ought to be carried up dry, or without mortar, the stones being laid with their smaller ends outwards, and their inner ends pointing to the centre like those of an arch, backed with hard materials. In forming a barrier of this sort, the largest stones should be used where the current strikes most forcibly against it; there, likewise, the greatest slope should be given to the wall.

The coping, or uppermost course of stones, is to be secured with tough sods, whose surface ought to be even with that of the stone-work; and similar sods require to be laid, with a gentle rising slope, until they unite smoothly with the natural turf of the land defended, so that the water of floods, when it rises above the stone-work, may have no projection to lay hold of, but may glide away smoothly.

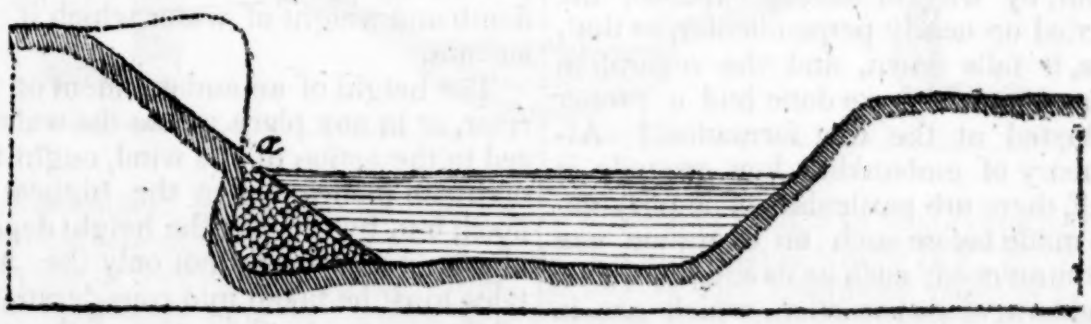
A bulwark of this sort, like every other species of river fence, requires to be attended to from time to time, especially after great floods. If the foun-

dation be injured, it requires to be repaired with small stones thrown loosely against the bottom of it. If any of the facing stones be displaced or loosened, they are to be replaced with others; or if the turf which binds them at the top be disturbed, the torn part should be cut out square with the surface, and be completely filled up with fresh turf.

Although instances may occur where the cutting through a sand bed, or the erecting of a barrier, may be employed to advantage in protecting river banks, yet, in most cases, the sheathing of the whole of the injured part of the bank with stones is preferable to every other species of defence. In most cases it is hardly possible to erect a single barrier so as to defend the whole of the injured bank, without a regular succession of them placed along the damaged part, so that they throw or ward off the water from one to the other, until the current has passed, or gained the straight course of the stream; and even in this case they cannot be so effectual as sheathing the whole of the injured bank; for let the barrier be ever so judiciously placed, the water is apt to make a whirl behind it, which not only endangers the foundation, but scoops out a hole in the solid bank immediately below, which it is impossible to hinder without placing them very near each other, the expense of which would be greater than sheathing the whole angle of the injured bank with stones. If we carefully observe the banks of rivers, we shall have no difficulty in remarking that the ravages are always greatest where the banks are perpendicular to a pretty considerable height above the ordinary surface of the water, and seldom at those places where the banks shelve down gradually towards the water edge; for when the water is swollen to a great height by rains, and runs with a rapidity greater than usual, it strikes violently against the perpendicular banks, undermining them, and carrying off prodigious quantities of their materials; but when the river rises to any considerable height, it gently glides along the surface of those parts of the bank that shelve gradually downwards to the water-edge, passing along without doing scarcely any damage at all.

These are facts which no one who has bestowed the least attention upon this subject can fail to have observed; and they clearly point out, that the first and most necessary step towards a cure is, to level down the edge of the bank next the water, giving it a regular slope to the surface of the water at the driest time of the year. This operation ought to be performed as early in the spring as possible; and the slope should be either immediately covered with turf, or, if the turf cannot be easily had, it should be sown very thick with the seeds of some small mat-rooted grass—the creeping meadow-grass, (*poa reptans,*) is a proper grass for this purpose. The bank being thus prepared, and level with the surface of the water in dry seasons, the breast of the bank below the water should be filled with stones, carefully thrown in, till they be near the surface of the water, and form the same slope from the bottom of the river as the bank above, as at *a* in figure 6. Stones collected on the

Fig. 6.



surface of cultivated land are best for this purpose; but where they cannot be obtained, any kind may be used, provided they are broken, next the water, to the size of a man's hand. The smoother the sides of water-courses are made, whatever the materials are, the current will glide more easily along without being ruffled; where there is no resistance there can be no friction.

Where the current is not too violent, a small portion of earth mixed with gravel ought to be thrown in with the last layer of stones next the water-edge *a*, which will not only fill up the crevices, but if a few aquatic plants be planted near the water-edge, they will sooner strike root among the stones. For example, the water spiderwort will grow in water four feet deep, and the roots of the yellow-flowered water iris form so strong and compact a covering upon the surface of the soil on which it grows, as to be almost impregnable to the action of water. This plant has another advantage attending it, that it grows on a firm bottom, and chiefly delights in running water.

The sheathing or protecting of river sides with small stones is so very simple in itself, that where stones are to be had there is not the least difficulty in preserving their banks at a trifling expense, provided the injured part be immediately filled. Instead of putting a few cart-loads in heaps at random into the affected place, they ought to be laid regularly along the affected part; for, in the first case, they only serve to break the current, forming partial waterfalls where there were none, whereby the injury is increased instead of being diminished; but, in the latter case, the bank will be secured. Even in districts where stones are not to be had, half the ravages committed by water-courses winding through low grounds might be prevented by timely and judiciously keeping down the perpendicular banks, and sowing or planting the slopes with small-rooted aquatic plants, such as bog reeds, sedges, water spiderwort, rushes, and seeds of any kind of plants which are known to thrive in and near water.

Before any work of this nature can be prudently undertaken, the given site or subject of improvement should be maturely studied, in order to discern the true method of procedure, especially if the river be the boundary between two proprietors; for although every man has a right to defend his property, it does not follow that because the one proprietor's lands are damaged, works should be run out into the river to the injury of the lands on the

opposite side; such a step would not only be imprudent, but highly reprehensible.

In ordinary cases, opposite proprietors have one and the same interest; and, by amicable and judicious arrangements, a considerable portion of the damages committed by the floods may be remedied at a trifling expense. How incumbent, then, is it upon the managers of estates to examine, from time to time, the state of the river banks, and, by appropriate means, to preserve them in due condition, and especially to be watchful of those which separate properties.

Embanking haugh and other lands, to prevent them from being inundated by land-floods, or the tide.

Having shown the necessity of straightening water-courses, and the best method of protecting their banks, we now come to the third branch of the subject, which is the embanking of haugh and other lands, to prevent them from being inundated by land-floods, or the tide.

Although this branch of country business is better understood than either of the former, yet considerable mistakes are often committed in the execution. They sometimes occur from the engineer not being able to discover the highest water-mark, but obliged to depend on the veracity of people who, although they might be brought up on the spot, never paid any particular attention to the rise and fall of the flood or tide, whereby a sure calculation could be made for the height of the proposed bank, even though it should be made considerably higher than the water-mark pointed out.* Another mistake is in not giving the bank a sufficient base, but, by way of saving expense, the slopes are carried up nearly perpendicular, so that, in a few years, it falls down, and the reparation costs more than it would have done had a proper plan been adopted at the first formation.† Although the theory of embanking low grounds is simple in itself, there are particulars of inquiry necessary to be made before such an operation can be properly commenced; such as its situation, size, materials, and form of construction, which are, in a great measure, given in the particular circumstances of every case: there are, nevertheless, general principles that are applicable in all cases.

The situation of the bank should be such, that its base may not be exposed unnecessarily to the immediate action of the waves or the current. In embanking rivers that run through a flat country, as the water is mostly sluggish, the embankment in such situations ought to be carried up in one slope, from the level of the surface of the lowest water in the river to such a height as may be found necessary for the protection of the land; and should the river be too much contracted, so as not to contain the water in time of floods, it ought to be enlarged, and the stuff taken out in forming it, or in cutting off any obtuse angle, (for it is always necessary to make the side of a river as smooth and regular as possible,) to be applied in forming the banks; but in situations where a river runs through a hilly country, whose sub-soil is, for the greater part, gravel, and the current of the water rapid, (as the Tay and Earn,) the embankment should not only be placed at a distance from the water edge, to admit of a cart to pass between the bank and the river, for repairing the sides of the river banks, but the small promontories the windings of the river have made should be left without the embankment; for should the embankment be placed so near as to confine the water too much, and proper attention not have been paid to the protection of the river banks, a single flood might undermine the embankment in a night's time, and thereby ruin the whole crop that was meant to be saved. The line of embankment should be *smooth* and free from acute angles, so as to occasion the least possible resistance to the current, whether of a land flood or the tide.

In the *construction* or form of the bank, there are certain principles to be observed. Its height and strength ought ever to be proportioned to the depth and weight of water which it will have to sustain.

The height of an embankment on the side of a river, or in any place where the water is not exposed to the action of the wind, ought to be at least eighteen inches above the highest known land flood; but, by the sea, the height depends on several circumstances, for not only the highest spring tides must be taken into consideration, but the rise of the waves by the action of the wind must be calculated, for if the height is not sufficient to prevent the spray from going over the top, the whole bank will be in danger of being washed down.

It is on the width of the bottom or base of the embankment that the strength, firmness, and durability of the bank principally depend. The slope ought to be made to a degree of flatness, for the twofold purpose of *preventing resistance* and *taking off* all the weight of water.

In difficult cases, the length of slope from the centre of the bank, on the side next the river or sea, ought to be five times its perpendicular height, and the inner slope from two to three times the perpendicular height, as represented in figure 7, A B C, or according to the force to be guarded against, and the materials to be employed. But in less difficult cases, such as on the sides of small rivers, where the current of the water is sluggish, and it does not rise more than four or five feet high, the length of the slope next the water may be three times the perpendicular height of the bank, and on the side next the land, twice its height will be sufficient, as shown by figure D E F.

In making embankments of this kind, the whole of their slopes next the river or sea should be covered with thin turf; but if the formation be done

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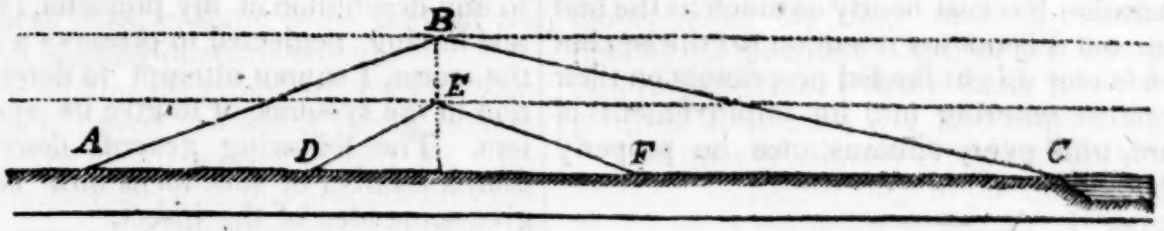
* A case of this kind happened to the author in the year 1823, in the neighborhood of Edinburgh. The embankment was made considerably higher than the water-mark shown by the proprietor and his gardener, but they having mistaken the flood-mark, the first land-flood carried away a considerable part, to the great damage of the crop, which the proprietor was obliged to make good to the tenant.

† An embankment of this description was thrown round the small island Mogdrum, in the river Tay, to protect the land from being overflowed by the tide; but it was made so steep, that the first spring tides levelled the greater part of it to the ground. A second attempt was made, with the additional expense of a stone wall facing the water, which shared the same fate with the former bank. Since these *failures*, a third embankment has been erected with nothing but the natural soil of the land, and the whole covered with thin turf. The length of the present slope next the sea is five times the perpendicular height of the bank, and the inner slope three times; the water, meeting no resistance, rolls up and down the long slope without doing any injury.

Fig. 7.



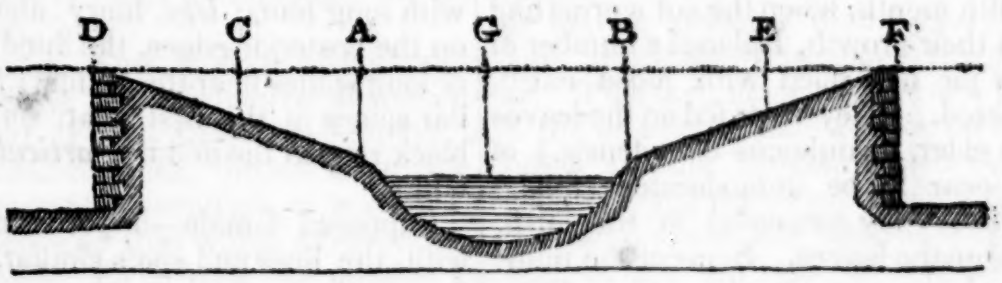
early in the spring, and turf not easily to be procured, the inner and upper part might be sown with grass seeds. In most cases, turf is preferable to all other materials for covering the slope; for if the turf is tough, and gets time to grow together before the autumnal floods set in, it will stand the agitation of the water better than a thin covering of stones. There are instances, however, such as in *reservoirs*, of the water often standing so long that the turf becomes rotten, and where the surface of the water is much exposed to the agitation of the *winds*, that a covering of small stones, from twelve to twenty inches deep, is unavoidable.

It is likewise necessary, in situations where an embankment is carried up from the lowest water-mark, that the foot of the slope should be protected with small stones, to prevent minor floods from undermining its base.

In the construction of an embankment, it is sometimes advisable to form part of the inner slope with stone and lime, for the twofold purpose of saving earth and making a fence to the land within the embankment; and, in executing a work of this kind, the *wall* ought to be carried up upon its own foundation, and substantially capable of resisting the pressure of the bank, whose earth ought to be well rammed down, immediately on its back, to prevent vermin from harboring behind the mason work. By not paying proper attention to this, many an expensive operation has been ruined in a few years.

Fence embankments are well adapted where the river makes the march between two proprietors' lands, or where it runs through lawn ground, or near a residence; for, in dry seasons, there are very few rivers whose water is sufficiently deep to prevent cattle from making depredations without some other fence, which often causes ill-will, and not unfrequently creates expensive litigations between neighboring proprietors or tenants, amounting to more than would have both embanked and fenced the lands.

Fig. 8.



To illustrate this subject, let us suppose figure 8 to be a river running through the grounds of A and B, whose water at floods overflows its banks. A is desirous to embank the land on his own side of the river, and, at the same time, to enclose them, so as to prevent the stock pasturing there from intruding on his neighbor. This is effected by means of the embankment C, with a stone wall raised five feet high in the inner slope D of the embankment; but although this completely protects the lands of A from floods, and, at the same time, keeps the stock within its own bounds, it does not prevent the stock of B from forcing its way through the river in dry seasons, and jumping from the top of the wall D into the field of A; therefore the proprietor B has no other alternative left than either to make a fence along the side of the river to prevent his stock from injuring A, or throw up an embankment E, with a sunk fence on the inner side F, as already done by the proprietor A.

Again, should the proprietor B make a common fence by the side of the river, to keep the pasturing stock within bounds, the land will be more exposed to the ravages of the floods than it was previously to the embankment on the opposite side of the river. Therefore, any proprietor who studies his own interest, ought to go hand in hand with his neighbor in guarding against all kind of encroachments on river banks, whether by water or pasturing stock.

The small portion of land lying between the river G and the bank fences D F, can either be cut for hay by each proprietor, or grazed conjunctly.

Some good specimens of *fence embankments* are to be found on the river Clyde, on the property of David Sim, esq., and on the Tweed, on the property of Sir James Montgomery, Bart. These embankments, but more especially the former, are very substantially made, so that there can be no doubt of their durability, and they are a good pattern to imitate.

Some very substantial earthen embankments have, within these few years, been made on the rivers Clyde and Tay, and on the Frith of Forth, which have given satisfaction to all parties; but there are others in different parts of the country that have been so superficially made, that they not only disgrace the planners, but every one who has been any way concerned with them. The failure of such undertakings is sufficient to prevent proprietors from laying out their capital in one of the most important branches of rural economy; and it is very much to be regretted that better advice is not obtained before an undertaking be commenced, when the whole success of the improvement depends on a few pounds more being expended than may be thought necessary by improper judges. To prove this assertion, I could point out many instances where embankments have been made within these few years, which, for want of proper di-

mensions, are either lying in a ruinous state, or their reparation has cost nearly as much as the first formation: but it is not my intention to criticise, but rather endeavor to put landed proprietors on their guard against entering into an improvement of this nature, until every circumstance be properly weighed.

From the Farmers' Cabinet.

THE CUT WORM.

A writer in the Cabinet, vol. 1, p. 6, says that the *cut worm* "is the offspring of the *phalæna destructor*; wings horizontal, white, with small dark spots, under wings, orange." The *phalæna* thus described may, for aught I know, produce *a* cut worm, but I am quite certain that it does not produce *the* worm commonly so called, in Pennsylvania. It is quite probable that more than one species of the worm may *cut* corn, and thence, acquire the name of *cut worm*. This is a point worthy of accurate investigation. I am acquainted with the insect described by "Senex," but not with its caterpillar.

Several years ago, I confined a number of cut worms in a box of earth, during their transformations, and succeeded in obtaining the moths, or phalænæ from them. Some of my agricultural friends made similar experiments. We all obtained the same result; but *our* phalænæ were totally different from that of "Senex." I determined to repeat the experiment the present year. About the end of the fifth month, when the cut worms had nearly acquired their growth, I placed a number of them in a glass jar half filled with moist earth, and loosely covered. They were fed on the leaves of the common elder, (sambucus canadensis,) of which they appear to be immoderately fond.* During the day, they lay concealed in the earth, and at night feed on the leaves. Some of the number died, but the larger part completed their larva state, and entered the earth to undergo their first metamorphosis. I examined the earth in the jar some days after, and found that the pupæ were each enclosed in a *ball* or *follicle* of clay. These follicles were composed of the common earth, cemented together by some adhesive fluid which the worm had furnished for the purpose. They were of a roundish oval figure—near an inch in their longer diameter, and smooth on the inner surface. The walls were about an eighth of an inch thick, and loosely connected with the exterior earth. They were somewhat impervious to water, as on trial, a drop placed on the surface, did not readily enter.

Nearly all the phalænæ made their appearance on the two first days of the present (7th) month.

The Linnæan genus phalæna, contains such a numerous assemblage of insects, and withal, so diversified, that subsequent entomologists have divided, and subdivided it, into a great number of genera. The number of the species, and the near resemblance of many of them, renders a distinct classification and description of them extremely difficult. Many of the modern genera have their characters drawn from the larvæ. Possessing little knowledge of entomology—not having access to any description of my phalæna, (if such exists,) and having neglected to preserve a description of the worm, I cannot attempt to determine its position in the systems, or to give its specific characters. The following *general description*, taken from a number of specimens now before me, will give some idea of the insect.

Pupa.—Length, about seven-tenths of an inch; smooth, shining, at first dirty white, or yellowish, becoming brown, or almost black—rudiments of the wings strongly defined—abdomen tapering, abruptly terminating in a short, bristle-like point; annuli or rings distinct, and quite movable—spiracles, or breathing holes, on the sides of the rings, projecting in form of short flattened tubes. Duration of the pupa state, about three weeks.

Perfect State.—*Color*, variable shades of blackish gray—*length*, three-fourths of an inch—*body* stout—*movements* sudden and rapid—*habits*, nocturnal. *Antennæ*, long, setaceous or bristle-shaped, *eyes*, lateral, large, black: *palpi*, projecting forwards, hairy, last joint very small, scaly; *tongue*, very long, horny, spirally rolled up beneath the head; *thorax*, tufted with long hairs, marked anteriorly with a transverse, wavy, black line; *wings*, horizontal, incumbent, the superior ones overlapping, ciliate or fringed behind, with long scaly hairs, and ornamented above with faint lines, and spots of different shades of gray and brown; inferior ones lighter colored, the inner margins folded and fringed with long whitish hairs; *thighs*, covered with long hairs; *legs*, hairy above, spinosi, ciliate on the posterior edges, the hind ones, with a pair of long spines near the middle; *feet*, with two similar spines at the first joint; *spines*, white, with a black ring in the middle; *articulations* of the feet white.

Supposed female—upper wings, silvery gray, with the lines and spots similar, but less distinct than in the male.

Habits.—I am not aware that the manner in which the cut worm phalæna deposites its eggs, has ever been observed. I can, therefore, only arrive at probable conclusions. As a very few phalænæ survive the winter season, it is probable that the eggs are deposited in autumn, among the grass, at or near to the surface of the ground. The eggs appear not to hatch until spring.

The correctness of this view, is inferred from the success of fall or very early spring ploughing, in preventing the ravages of the cut worm. It may be proper to inquire a little, how winter ploughing produces this result. I apprehend that the eggs become buried so deep in the earth, that the vivifying influence of the sun and air does not reach them, or if they do hatch at such a depth, they must perish before reaching the surface, where alone food is to be found to nourish them. In late spring ploughing, the same thing would not so certainly happen; vegetation having started, the proper food for the worms would be buried along with them, and the loose state of fresh ploughed land not only admits the free passage of warmth and air, but would greatly facilitate the egress of the worm to the surface. Even should the moth survive the winter, and not deposite its eggs till spring, the foregoing explanation will apply equally well; or if the moths should find the ground already ploughed, they would probably seek some other field in which to deposite their

* Hence, it is the practice of some farmers, when the cut worms are numerous, to strew bunches of elder leaves over their corn fields, and in the morning, go round and destroy the worms which are found collected under them in large numbers.

eggs. It is generally admitted, that *fall or early spring ploughing* does, in some way, prevent the cut worm from injuring our corn crops.

Some prefer having the sward imperfectly turned down, so as to have a portion of grass remaining on the surface for the worms to feed on. But these should remember, that this practice may preserve alive a number of worms sufficient to do the corn a serious injury. By turning all down, they might destroy the worms, and render the precaution of feeding them unnecessary.

Another means of lessening the injury from the cut worm, is to plant deep. The heart of the plant remains longer in the ground, and if the worm should cut it off above, the growth is but little retarded.

I hope others will investigate the subject, and make known the results.—*Farmers' Cabinet.*

For the Farmers' Register.

ACCOUNT OF THE SOILS AND AGRICULTURE OF WESTERN NEW YORK.

During a recent visit into the interior of New York, I had an opportunity of forming some idea of the extent and fertility, the agricultural products and resources, of that interesting portion of our country. As there is a natural desire amongst the intelligent part of the agricultural community, to be informed of the comparative advantages and the practices of other states, I venture to submit the result of my observations to the readers of the Farmers' Register.

The western part of New York is undoubtedly one of the most fertile and productive districts in the United States. From Utica to Niagara, a distance of two hundred miles, the soil is capable, with some inconsiderable exceptions, of sustaining a population as dense as that which exists in any part of the old world. Even now the number of inhabitants is very great, notwithstanding the constant tide of emigration to the new and fertile regions of the west; and this cause alone will probably prevent it from reaching its maximum during the present century. With unexampled facilities for the transportation of produce to market, and with abundant means at hand for the continual improvement of the soil, nothing is wanting but intelligence and stability to make a garden spot of this extensive region. The climate alone may be regarded as unfriendly: for winter intrudes upon nearly half the year, which causes a heavy draught on the labor of the country during the season of vegetation.

In estimating the agricultural merits of a country, its natural structure may be regarded as an important object of consideration. I shall, therefore, introduce such remarks on this subject as would probably occur to any person whose attention might be directed to it. I regret, however, that I was not able to have access to the report of the geologists of the state, made to the last session of its legislature, that I might avoid those errors into which a traveller may inadvertently fall, from the slight examination it is in his power to make. But I trust that if my description shall be thought erroneous in some of the details, it will yet be found sufficiently accurate to answer the purpose for which it is introduced.

A traveller then would naturally lay off the western part of New York into three divisions: 1, from Lake Ontario to the Gravel Ridge, commonly called the ridge road: 2, from the ridge road to the mountain ridge: and 3, from the mountain ridge to the Pennsylvania line. Upon each of these divisions I will offer some remarks.

The tract of country lying on the shore of lake Ontario, and extending to the ridge road, may be from five to ten miles in width. It is but slightly elevated above the level of the lake, and so perfectly flat and unbroken, that the motion of the streams is sluggish in the extreme. The soil however, which is a black sandy loam, does not appear to be retentive of moisture; and having a slight admixture of lime in its composition, is very productive of corn and oats, when it can be effectually drained; and moderately so of wheat. Its low situation must render it injurious to health. The ridge, which constitutes the southern boundary of this division, prevents a curious and remarkable feature; and indeed is perfectly anomalous, as far as my information extends, with the exception of a similar embankment on the south side of Lake Erie. It is apparently elevated about twenty-five or thirty feet above the level of the land on the north, and something less above that on the southern side. It is almost wholly composed of sand and gravel. At one place where there had been an excavation for the purpose of getting materials to construct a road, there was only a small portion of sand on the surface. The pebbles, which are smooth and formed of red sand-stone, were without a particle of other matter amongst them, except a deposite of lime, which served to cement them slightly together. This fact alone, shows the presence of lime in the adjacent soils. It was, no doubt held in solution by the waters, which once covered the country, and deposited equally over every part. To what cause this natural embankment is owing, it may perhaps be difficult to explain. It will be perceived from the description, that it is of diluvial formation; and many persons have supposed that it constituted the former boundary of the lake. To this theory, however, there are several objections. One is, the absence of a corresponding formation on the northern shore of the lake; another is, that the bank is considerably elevated above the land on its southern border; and a third one is, that near the western extremity, there is an entire interruption for several miles, where no traces of it can be found. Towards the western termination of the eastern portion, the ridge deflects suddenly to the south, and shortly becomes merged in the general suface. Travelling thence to the west, it is met with again at the distance of six miles, when the ascent to the summit, is some what abrupt. Thatits existence, however, was connected with the vast bodies of water to the north, cannot be questioned. At a distant era, and during the convulsive throes of nature, we may suppose that a tremendous wave or succession of waves rolled in from the north, sweeping the earth as they advanced, and that they expended their force at this point. But to whatever cause its origin may be referred, it forms during its whole length, a natural road, not to be surpassed in excellence, nor equalled in durability by the most approved work of artificial construction. Its summit is not more than sufficiently broad for a road of convenient width, and generally speaking, the surface is equally smooth in winter and

summer. Along such a great thoroughfare, it may readily be supposed that the population is very numerous. Accordingly each side presents somewhat the appearance of a continuous village. The houses are generally on the declivities, and so near to the road as only to allow of yards of the most contracted dimensions.

The next division, embraced between the ridge road and mountain ridge, presents a more varied surface than the one I have just described. In some parts it is quite broken, with sandy and gravelly, hills of diluvial formation running from north to south, and plainly marking the direction of the currents which once swept over it. For the most part, however, it is a beautiful undulating country, with a soil of good texture, sometimes rather heavy; impregnated with lime, but not belonging to the limestone formation. The red sandstone forms the basis of this region as well as of the other. A great number of granitic boulders are scattered over the surface, which, from the total absence of such original formations in the western part of the state, were evidently brought from beyond the lakes. Broken limestone rocks are also to be met with. It is through this tract, that the Erie canal is taken for a considerable distance; and the benefits, which have resulted from that great public work are no where so strikingly displayed. Villages have sprung up along the whole line, as if by enchantment, and the industry of man is developed in a thousand ways.

There are, however, some portions of this district that are very imperfectly drained—large swamps of fertile land, yet remaining in a state of nature. The chief obstacle to effectual draining is the gravel ridge, through which the streams have, in some instances, found a difficulty in effecting a passage. It was highly interesting to witness the abortive efforts of one of these in particular, repeatedly made during a distance of eight miles. Approaching the embankment in the first instance rather obliquely, it was repelled, after having made a considerable excavation into its side, when it flowed back as if to acquire fresh strength to return to the attack. This was renewed at various intervals, with the same partial success; but at length the object was achieved, and it pursued its sluggish course to the lake. At some points it has been found necessary to open a passage through the ridge, to let off the superfluous water; and much yet remains to be done, owing to the small number and size of the streams, seeking for an outlet, and finding but few.

The southern boundary of this division is not so distinctly marked towards the eastern, as it is at the western extremity. At Williamston, on the Niagara river, and at Lockport, the mountain ridge is probably a hundred and fifty or two hundred feet in height, presenting to the eye the appearance of a *bluff*. Travelling east from thence, its relative altitude becomes gradually less conspicuous, until at length it is difficult for a casual observer to distinguish the line of separation.

But the most important portion of the state is the one which remains to be considered, whether we regard its extent, its fertility, its population, or resources. The other districts are deservedly thought to be fertile, and would be eminently entitled to that character if they were situated on the eastern side of the mountains; but this far transcends them in every natural advantage. After ascending the mountain ridge, a vast table land stretches to the south, high, dry, and gently undulating, and possessing a climate remarkable for its salubrity. This is the limestone region of the state; and it is here that the beautiful and picturesque lakes are found, which from so unique a feature in the geographical history of New York. The limestone overlies the red sandstone to the depth of perhaps five or six hundred feet; and in many places the soil is covered with broken fragments of the same, mixed with boulders of different varieties of granite. Where these occur in considerable numbers, it requires great labor to subdue the land and prepare it for cultivation; but they are not considered such a serious objection as one might suppose, who has not been accustomed to them. They furnish materials for building houses and making enclosures; the latter of which, when put up with skill, require but little trouble to be kept in repair. This, however, is but a small portion of the service they have performed; exposed, for ages, to the action of the elements, they have become obviously disintegrated, and have afforded such an abundant supply of lime to the soil, that it may be truly said to be inexhaustible. So great is the amount of calcareous matter, it contains, particularly at a few inches below the surface, that a brisk effervescence ensues when mixed with acids. I would not wish, however, to be understood, to say that this is uniformly the case; but the quality of the land is apparently so nearly the same, and the disjointed limestone is distributed so regularly over the surface, that I can only regard the absence of an equal proportion of the carbonate of lime, as an occasional exception of the fact I have stated. When we add to the knowledge of this fact, that there is never any parching of the earth by drought, as is so often the case in more southern latitudes, it can no longer be a matter of surprise, that the crops are so abundant, or that the farmers of New York, on tracts of land from one hundred to a hundred and fifty acres in extent, should grow rich by the cultivation of the soil. Of their system of agriculture I shall speak in the proper place.

The lakes, I have said, form a remarkable feature in the geography of the state. They lie parallel to each other, extending from south to north; and every great natural valley is a reservoir for the waters of the neighboring streams. They are of very unequal elevation; the surface of the Cayuga, for instance, being forty feet lower than that of the Seneca, lying by its side, not more than twenty miles distant. This is obvious from the fact, that the outlet from the Seneca empties into the lower end of the Cayuga; and along its margin there is water power, to considerable extent. The deepest part of the Cayuga lake is about two hundred and fifty feet, which renders it probable that the red sandstone forms the basin of these interior lakes, as well as those of Ontario and Erie. Near the extremities, however, the depth is not so great. They were formerly inhabited by shell fish in large numbers, as is evident from the extensive bed of marl found at the lower end of Cayuga. It is very pure and of such whiteness that it was formerly used for whitewashing the farm houses; but it is latterly substituted by stone lime. No use has been made of it for agricultural purposes.

These lakes, besides affording great facilities for intercommunication, agreeably diversify the country, and render it doubly charming to the lover of the picturesque. They are frequently seen by the traveller for miles before he reaches them, and in connection with the country, lying in the distance on the opposite side, they furnish landscapes, truly enchanting. Perhaps I could not convey a better idea of the beauty and situation of the country in their vicinity, than by briefly describing one of these landscapes. It was on a delightful afternoon, in the month of August, when I approached the west bank of the Cayuga lake, with the intention of crossing over in the little steamer, which incessantly plies from one side to the other, a distance of three miles. Being detained longer than I expected, I had a favorable opportunity of contemplating the scene before me. The transparent sheet of water stretched far to the south, and on its unruffled bosom lay the little crafts, without a breath of air to move them; the opposite shore was sprinkled with numerous villages, whose white houses glittered in the soft rays of the evening sun; while beyond, in the back ground, the country rose from the water, for five or six miles at a regular slope of a hundred feet to the mile, showing to infinite advantage the numberless small farms, and neat farm-houses, like patches in the distance. It was altogether unrivalled by any thing I had even seen, though I had scaled the summit of the Peaks of Otter for the purpose of having a view of the surrounding country, and had gazed with delight from the brow of Laurel hill, which overlooks the western part of Pennsylvania.

In describing a country, it is proper to say something of the natural growth of the soil, as it is considered an indication of its quality. The forests of New York are extremely dense, and remarkable for the size, and particularly for the height of the trees. In summer, their foliage presents a shield through which the sun can seldom penetrate. The most magnificient production is undoubtedly the American elm (*ulmus americana*); and the *u. racemosa*, a species peculiar to that locality, is scarcely inferior to it. The sugar maple and black maple—the tulip tree or poplar of the south (*liriodendron*)—the bass wood (*tilia glabra*)—the beech and the two species of walnut—are the fitting compeers of the elm. Besides these, there are many of the second class, amongst which, may be enumerated the cucumber tree (*magnolia acuminata*), the white and black ash, the cotton wood (*populus angolata*), and several species of oaks. I was rather mortified to see these monarchs of our southern forests hiding their diminished heads beneath the elm and the maple. The soil is doubtless less congenial to the oaks than it is in the south, which are scrubby and stunted in comparison with the size they attain in Virginia. The species are, moreover, limited to a small number. The pines are only occasionally seen in the western part of New York; and when they do occur, it is in sandy districts of limited extent, between the limestone lands and the lake. The white pine (*pinus strobus*,) is the most majestic, as well as the most valuable. The hemlock (*pinus canadensis*)—the Norway pine (*p. resinosa*)—the hack-match (*p. pendula*), and some inferior species, together with the arbor vitæ (*thuja occidentalis*,) grow in the same localities.

The extreme luxuriance of the deciduous forests on a highly calcareous soil, struck me as being incompatible with the theory of an ingenious and distingushed writer published in a former volume of the Farmers' Register. In treating of the origin of the western prairies, he endeavored to sustain the position, that the presence of carbonate of lime was unfriendly to the growth of timber. If the position was assumed without any qualification, the facts I have stated must go to invalidate it; but if he had reference only to the oaks, which constitute the principal growth amongst the prairies, the limited number and small size of those growing on the limestone soils of New York may measurably tend to support it. Besides, there are many hardy southern plants, as I was informed, which will not flourish, or even grow in the calcareous soils of that state. I regret that I cannot now enumerate them.*

I should not omit to state that the precipitous banks of the Niagra river afford an interesting and imposing view of the geological structure of the contiguous country. In the immense chasm which the current has worked out, we have, almost at a glance of the eye, a sight of the different rocks which are found in the western part of the state. The strata are disposed so nearly horizontally, that we must suppose the elements to have been in a state of almost entire quiescence during their deposition. There is, however, a gradual dip to the south, which becomes apparent in ascending the river. Begining at the base of the mountain ridge, the red sandstone forms the substratum, which is distinctly visible for two or three miles up the river. Overlying this, and commencing at the mountain ridge, is the common limestone, rising suddenly to the height of some two hundred feet. Ascending the river some miles, this deposite gradually sinks, and an-

* The position assumed in the 'Essay on the formation of prairies,' (p. 321, vol iii.) which is referred to above, was not meant or stated as unqualified, or universally true. The writer believed, indeed, that a calcareous soil was less favorable to the growth of most forest trees, than a soil not calcareous. To some kinds, (as specified above by our correspondent.) such constitution of soil may be *positively* as well as *comparatively* unfavorable—and to others, as of the most usual kinds and numerous pines, a calcareous soil is altogether unhospitable, and seldom permits a single tree to live. On the other hand, some trees thrive best on soil containing mild calcareous earth, and will hardly live where that ingredient is altogether deficient, and greatly wanting to the constitution of the soil; of these, the common locust (*robinia pseudacacia*) is the most striking example.

But the mode in which the calcareous quality of soils was supposed (in the theory of the formation of the prairies,) to prevent the growth or continuance of trees in general, was not only, nor principally, by being *directly* unfavorable—but *indirectly*, by favoring, in a much greater degree, the growth of rank grass, which furnished every winter more and more fuel to the fires, as the trees more and more gave way to their effects, and to the more vigorous and increasing growth of grass.—Ed.

other of the fœtid limestone commences, and continues with equal regularity. At the falls, which are seven miles from the mountain ridge, this is the only rock to be seen, which in its turn is overlaid by the hornstone or cornitiferous limestone, upon which the waters of the Niagara flow, after being discharged from Lake Erie. If, therefore, as some writers suppose, the falls are gradually receding, the hornstone will offer a barrier at which their progress will be arrested, and which they can never by possibility overcome.

Having dwelt, perhaps too long on subjects of a general character, I shall defer, until another month, the remarks I propose to offer on other matters.

[To be continued.]

COMPARISON OF HORSES AND OXEN.—ESTIMATE OF THE WORTH OF CORN-STALKS AS MANURE.

To the Editor of the Farmers' Register.

I observe that in your last number there is a letter to you from Mr. Burfoot, mentioning a passage in Sir John Sinclair's 'Code of Agriculture,' in which a paper on horses and oxen, by the late President Madison, published in the American Farmer, is mentioned with approbation, as well as two papers published in that work from G. W. Erving, and T. Pickering, on the same subject, and requesting you to publish these writings in your Register, to which you add a note that they shall appear in your next number.

Mr. Madison's paper, as it is called, is no doubt his address to the Agricultural Society of Albemarle, on various topics of husbandry—a respectable essay certainly, and written in a style of purity and neatness that generally belongs to Mr. Madison's writings. It contains some very good advice to cultivators, but I think a number of errors, which is not extraordinary, considering that Mr. Madison's time was engrossed by public affairs. That part of it which relates to the comparative value of oxen and horses in cultivation, I think the most strikingly erroneous, and I rather believe that you yourself would regret to find that Mr. Burfoot, or any other respectable farmer, should be led away by it, to discard the use of horses, and substitute that of oxen. That both are valuable in their places, I have no doubt; but for the main objects of husbandry, on a wheat and corn plantation, I think horses, beyond all question, preferable. As Mr. Burfoot has referred you to the 'American Farmer,' I would ask your attention to the latter part of a letter to the editor of that work, vol. 2d, p. 140, which presents such views as I have always had on this question, though perhaps rather more favorable to oxen than they ought to have been; still I think them in the main correct.*

It would be a remarkable and extraordinary fact that Sir John Sinclair and Arthur Young, who have both written a great deal on agriculture with ability, and have given much useful information to farmers, should have taken up the question in favor of oxen with so much zeal, in opposition to the general and almost uniform practice of the most judicious cultivators of the soil in both England and Scotland, were it not understood that neither of them was considered a good practical farmer. The point, so far as I understand, is now settled in England, as well as Scotland; and horses are employed for all kinds of labor that requires long and severe exertion, though oxen are occasionally used with advantage for short distances, with frequent interruptions to load and unload.

In Virginia there may be examples of active and successful husbandry on grain farms, where oxen are used instead of horses, for the principal crops; but I have never met with any such on farms of a good size; and am willing to believe, and indeed to hope, that no material change in this respect is likely to take place among us.

Observing in your Register, various and contradictory opinions on the value of corn stalks as a manure, I will offer my views of the subject; they are probably of little or no value, but you can take them for what they are worth.

That the corn stalk is of some value by itself for manure, I have no doubt, as it is a vegetable substance; but I should rank it very low in the scale of vegetable manures, if it were turned in, or spread on the soil, in its natural state; still I consider it as a highly valuable manure, when used as it is by the most judicious farmers of my acquaintance. In a farm pen, with a good clay foundation, hollow in the centre, corn stalks hauled in from time to time in the winter season, and trampled by cattle, become saturated with the urine, and more fluid dung; and in this way, a single light load of corn stalks, may be converted into several heavy loads of rich manure. 'Tis true the stalk itself furnishes but a small proportion of this substance, but as much the greater part of it consists of a pith that absorbs fluids like a sponge, and, as I think, in a considerably greater degree than straw, leaves, or any other vegetable substance that can be used for the purpose, it is in proportion more valuable. In England, Flanders, and other well cultivated countries in Europe, we are informed that fluid manures from cattle, are carried out in casks for irrigating their lands, and sand and earth are frequently carried into farm pens, that they may become impregnated with this kind of manure, and then spread on their lands. I think corn stalks unquestionably preferable for this object, and indeed am so partial to them, employed in this way, that I verily believe if two grain farms were equally well managed in other respects, one of them with, and the other without the free use of corn stalks in the farm pen, the former might be in an improving, and the other in a declining condition. My notions on this point, may be carried too far, but I think it unquestionable that, used in this way, corn stalks are a most useful and convenient vehicle for a highly valuable manure.

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*The article referred to will be copied below.—Ed.

Extract from the American Farmer, of July 28, 1820.

"This subject brings to my recollection the opinion of another foreign writer of great celebrity, upon a question that has been much canvassed in your paper; whether horses or oxen are preferable for the plough? In the middle states, horses I believe are very generally employed, while in New England oxen are almost universally preferred, and most of the writers whose opinions are given or quoted in your paper, are in favor of the latter.

In England, while the cultivators of the soil very generally use horses, most of those who write on the subject condemn the practice, and strongly recommend the employment of oxen. In the old edition of the French Encyclopædia under the article *Fermier*, is an essay by the celebrated *Quesnay*, (who has been called the "*Father of the Economists*," and to whom Adam Smith is said to owe many of the principles contained in his 'Wealth of Nations,') in order to prove that horses are greatly preferable in agriculture to oxen, and that the general use of the latter in France is a public misfortune, occasioned by the poverty of the farmers. The subject is treated at large and as might be expected, with much ability, and there are arithmetical calculations showing clearly, if the *data* are admitted, the great superiority in nett profit of horses. I do not send you a translation, as well from the want of leisure, as because it might occupy too large a space in your paper. The work no doubt can be met with in Baltimore. My own opinions on this subject are of no authority, and are probably of no value; but I am strongly inclined to think that the practices in France and in England, in the wheat country of the middle states, and in New England, although opposite to each other, grow out of the situation of these different countries, and their inhabitants. In the greater part of France, oxen were used from necessity; the *metayers*, or *farmers on shares*, by whom the lands were generally cultivated, having too little capital to provide horses. In England where there is no want of capital, the farmers prefer horses, as though they cost more, and are maintained at a greater expense, they do much more work, and, on the whole, yield a greater profit. In the New England states, there being much more land occupied in pasturage and meadow, than under the plough, they have large stocks of cattle, and little or nothing is lost by working their steers till they are of a fit age for the slaughter house; and the plough being subject to frequent interruptions, and a slow draught through an uneven soil, encumbered with stones, oxen are peculiarly fitted for that work, while in the wheat country of the middle states, where a large proportion of the lands must be subjected to the plough at particular seasons, and within short periods, horses are generally much more useful for this purpose than oxen. Indeed the form and action of the horse, compared with that of the ox, would leave little doubt of the superiority of the former, wherever strength and long-continued exertion should be wanted. Most of the calculations which go to show that oxen are preferable to horses, proceed on the admitted fact, that an ox costs less than a horse, and is maintained at a smaller expense; but I think without a sufficient allowance for the greater number of the former that must be employed to do the same work, and the additional number of hands that they require. Still there are various uses to which oxen may be employed on a grain farm to advantage, as in hauling wood, grain, hay, manure, &c. when the draught is slow, and frequent interruptions to load and unload afford time to rest; and when not wanted for other purposes, they may occasionally be employed with the plough or harrow; but any judicious and active farmer, preparing in the hot months of August and September for a large crop of wheat, on lands free from roots and stone, I believe would have very little hesitation in giving the preference to horses on a fair comparison. These loose hints are hastily thrown together, you will make whatever use of them you may think proper."

For the Farmers' Register.

PROPOSAL TO PUBLISH,

"THE HUSBANDRY AND HORTICULTURE OF THE ATLANTIC STATES, DEDUCED FROM THE MOST AUTHENTIC SOURCES, AND FROM PERSONAL OBSERVATION DURING AN AGRICULTURAL TOUR,"

By James M. Garnett, of Virginia.

Several years ago, it was proposed to publish, by subscription, a work under a title somewhat similar; but the number of subscribers, although very respectable, proved inadequate to defray the necessary expenses of the undertaking, and it was abandoned for the time. The author's desire, however, to make such a publication has not been extinguished by former disappointment; and he has been encouraged to renew his proposal by the fact, that the spirit of inquiry, so important to the great cause of American husbandry, is now far more active and widely diffused, (thanks to our excellent agricultural journals, both north and south,) than at any former period.

All who have studied rural economy, must have observed our great want of some book containing something like a connected system of North American husbandry—to comprise the various improvements made within the last half century, in this highly important branch of human knowledge, and to condense them in a form sufficiently compendious and intelligible to serve as a convenient manual for the agriculturists of the United States. We have numerous and very valuable foreign works—comprehending all, perhaps, that was known on the subjects of which they treat, at the time of their publication. This knowledge however, (to which much has been added since,) is scattered over many volumes, comparatively expensive to procure, and blended with various other matters having little or no interest for the cultivators of the American soil. No work of the kind relative to our own country, can any where be found; at least none of recent date, and sufficiently comprehensive to be well adapted to all the Atlantic states, and devoted exclusively to illustrate the present most approved practice in every branch of American husbandry. To ascertain this, therefore, no other mode can be adopted by individuals, but to make a tour through them, for this special purpose. Very few, however, can afford either the time or the money, to accomplish such an object, highly desirable as it certainly is; although all might attain the end at a very small expense, by contributing to enable some one in whom they could place confidence, to execute for them, that which they could not individually do for themselves.

It is true that our numerous agricultural journals furnish much valuable information, but not unfrequently adulterated, (as their best friends admit,) with irrelevant matter, and prolix, fanciful speculations, which their editors cannot well avoid publishing, without giving unnecessary offence to their correspondents, who are the authors of these com

munications. Moreover the circulation of these journals is confined chiefly to those particular sections of country to which they are supposed to be best adapted, and consequently treat much more of local than general husbandry. Their contents, too, consist, in a great measure, of anonymous articles, in spite of every thing their editors do to prevent it; and thus necessarily fail to acquire that degree of authority and influence which they might otherwise possess. No one, therefore, of our agricultural papers could well be used as a manual of husbandry for every part of the Atlantic states, and hence the necessity of such a work as the one here proposed, in addition to those highly useful and interesting periodicals. An additional argument in its favor is derived from the fact, which must often have been noticed by all who have travelled to improve their knowledge of rural affairs, that there are many valuable machines, implements, processes, and practices of husbandry, the knowledge of which is yet confined within very narrow limits; simply, because those who enjoy the benefit of them, either believe them to be common, or have too little public spirit to make them generally known. With all such matters the author designs to become as thoroughly acquainted as he can, during an agricultural tour through the best cultivated portions of the Atlantic states, preparatory to the completion of his work; provided the number of subscribers will warrant the expenses which must necessarily be incurred for such a purpose. He will rely upon his own personal observation as far as practicable, for all facts and details; and where that cannot be made, upon information carefully collected among the best informed and most experienced agriculturists he can find in the different states through which he intends to travel. In his whole book there shall be nothing of those fanciful theories, and abstract speculations, surcharged with scientific terms, which have contributed so largely to bring all kinds of agricultural works into ridicule and neglect, by those opinionated sciolists in husbandry, who seem to take a pride in their ignorance of every thing which has ever been printed and published on the subject. Under the cant term of "*book-farming*," all have been confounded together in one indiscriminate denunciation; and consequently their circulation has been, in a great measure, confined to those who have really least need of them. It may possibly be deemed very presumptuous in the author to hope for any better success than his predecessors have had, in his efforts to disabuse his agricultural brethren of the United States, in regard to that most irrational prejudice entertained by so many of them, against books on husbandry. But when he assures them that his sole object is to collect and publish facts which will prove highly useful to us all, and which probably may never be generally known, unless somebody will make it his special business to go in search of them. He trusts that the result of his labors may meet with a more favorable reception, than if he tendered his services rather as a teacher, (to which character he makes no pretensions,) than a mere reporter of the best practices of others in every branch of husbandry. Of this he believes himself capable, and also of giving the requisite details with sufficient minuteness and accuracy to make his book a convenient manual for all who desire such a guide. On the score of execution, he promises nothing more than diligence in research, fidelity of representation, and a constant effort to render all his statements perfectly intelligible to the most illiterate reader.

It is a part of his design to aim at relieving the dryness of details relating merely to rural affairs, by occasional remarks on state peculiarities, and prejudices, than which nothing has more impeded the progress among us of all useful knowledge, but especially of husbandry. In this vital art—the ever bounteous nurse of all the rest—it is undeniable that some portions of our union are a century or more behind others; and that the sole cause of it is, the prevalence of those violent and senseless *antipathies*, (as they may well be called,) which a very large part of the citizens of the different states indulge against each other. They have prevented, to a most injurious extent, that harmonious and frequent intercourse between the members of the great American family, so essential to their peace and happiness; they have made enemies of natural friends; and they have kept the great mass of each community utterly ignorant, not only of their true interests as component parts of our grand confederacy, but of the progress made by each state in all the useful arts of life. Destroy this ignorance—cure these antipathies, and the ties which should bind us together as a nation, will prove as indissoluble as they are endearing. It is a consummation which every true friend to his country must desire most ardently; and no means appear better calculated to accomplish it, than first to expose each others frailties and faults with candor and impartiality; and secondly, by making known to all the various improvements made by each in that vital art which, far beyond every other, conduces most to individual and national prosperity. This is the *art of good husbandry*. How far the author's labors may contribute towards the attainment of the great objects he has in view, remains to be proved. He may possibly share the fate of those volunteer peacemakers who interfere between man and wife; but, in any event, he will console himself with the consciousness of having been the first to plan and to undertake a work which cannot possibly fail to be highly useful, if properly executed.

Estimates derived from the most authentic sources of the present nett profits of husbandry in each of the Atlantic states, will occupy a portion of his work; together with plain drawings of such agricultural implements and machines, as appear to him best calculated for their destined purpose; provided he believes they can be made from linear representation without models. To this will be added some cursory views of our manufacturing establishments, and their effects upon our agricultural interests.

The whole will conclude with an appendix of approved receipts in rural economy, either tested by the author himself, or by such other persons as are deemed fully worthy of confidence.

Conditions.—Should the amount of subscriptions be sufficient to defray barely the necessary expenses of the undertaking, the work will be published, (if the author lives,) in the course of the next year. It will be in one large octavo volume, the price to subscribers $3 in boards, and $3 50 for a well bound copy, lettered on the back.

Any person who will procure subscribers for 10 copies, and guarantee the payment, shall be en-

titled to one copy for his trouble. The same shall be given to any person who will forward the signatures of 20 subscribers, his own being at the head of the list, but without guarantee. No money will be required until the delivery of the book, but letters addressed to the author by any person or persons wishing to subscribe, must be post paid, and directed to Loretto, Essex county, Virginia.

Subscribers are requested particularly to designate the state and county or town in which they reside, their respective post offices, and whether they want copies in boards or ready bound.

N. B. The editors of our agricultural journals, throughout the United States, are requested (if it be compatible with their terms,) to give this prospectus one insertion in their respective papers.

Oct. 7, 1837.

[It is not only in compliance with the request made above, but on account of the value and importance of the proposed work to agricultural interests, that we insert the proposal at length in the body of this journal, though it may perhaps be deemed, in some degree, in opposition to our rule to exclude every thing in the nature of an advertisement. Mr. Garnett's long and zealous efforts to stimulate the improvement of agriculture, his extensive reading, and general information on the subject, and his talents as an accurate observer; and excellent writer, form very high qualifications for executing well the work he proposes to undertake; and if he is enabled, by sufficient aid, to prosecute his labors, we hazard nothing in predicting that his full report will make a valuable addition to the agricultural information of Virginia.]

COMMERCIAL REPORT.

The business of the past month has been to a tolerably fair extent. The reduced terms of credit on sales in New York, and other northern cities, and the difficulty of exchanging southern for northern funds, have induced many of the country dealers to obtain their supplies in Richmond and Petersburg.

If adequate importations of goods be hereafter made into these and other southern ports, there is no doubt that a large portion of the trade of the interior may be retained at home, and our dependance on the north be proportionably diminished. Capital and enterprise cannot be more profitably employed, if we may judge by the success of those who have made the experiment.

Importations from Europe, during the last six months, into New York, &c., have been inconsiderable in consequence of the almost total destruction of American credit during that period, and of the indisposition of those whose credit was unimpaired to risk it, until the consequences of the general derangement of commerce should be ascertained. The worst, it is believed have now been seen, and unless some new experiment be made, the effects of previous ones may be gradually removed. Large exports and moderate imports will reduce the rates of foreign exchange, and consequently, the exportation of specie, and enable the banks to resume the payment of it, with safety to themselves and benefit to the community.

At present, the little specie that circulates in our small community is gradually collected into the post offices and custom houses, whence it is not reissued; the payments made by the government being by checks on their deposite banks, or in other words, in bank notes. The inconvenience is thus constantly increased, and if the revenue of the government were as great now as heretofore, so that a large surplus could accumulate, a specie currency could not possibly exist. Government, instead of creating, would destroy it. Fortunately, there will be no surplus to enable the treasury to hoard up specie.

Exchange on England, which has been as high as 22 per cent. premium, has declined to 16, and specie in the same proportion, from 12, to 5 or 6 per cent. Between different parts of the country a great difference in exchange still prevails—even between New York and Philadelphia, 1 to 2 per cent.; and between other places, various rates, from 2 to 10 or 15 per cent. All sorts of small bills are in circulation, from five cents up to as many dollars, whether legal or illegal.

Prices of domestic produce of all descriptions have improved. The diminished quantity of tobacco, compared with last year, as shown by the inspections in Virginia and New Orleans, has caused an advance in that article, though it is believed that a larger quantity than usual remains in the interior, primarily owing to low prices in the spring and summer, and subsequently to the interruption of internal navigation. A drought of long duration has dried up the smaller streams, and suspended the navigation of our rivers above tide water. Sales of tobacco range from $2¾ to 8½. The inspections, &c., in Virginia, exhibit the following results, for the years ending 1st October.

Inspections, 1836—45.300 hhds		1837—36.000 hhds
Exported,	30.700	18.700
Stock,	14.000	10.000

In New Orleans.

Received, 1836—49.934 hhds.		1837—28.196 hhds.
Exported	43.941	32.725
Stock,	7.277	1.511

Prices in New Orleans and in Kentucky, were at one time so low, and the scarcity of money so great, that tobacco of inferior quality would scarcely sell for enough to pay the charges, and, consequently, the planters ceased to send it to market. Prices have recently advanced, but the tobacco in the interior cannot probably reach market very soon.

Wheat has advanced to 170 to 175 cents per bushel. The crop east of the mountains proves deficient in quantity, and although the price in the western states (on the Ohio,) is comparatively low, supplies of flour from thence do not usually arrive until the spring. Meanwhile, the western part of New York is relied upon as the most abundant source of supply, and the daily receipts from thence have recently been 6.000 to 10.000 barrels; but the demand has kept pace with the supply, which is considerably less to this period than in former years, and will require some weeks of open navigation to make up the deficiency. Flour of country mills in Virginia, commands $8—but owing to the drought, the supply is inconsiderable.

There will be importations of grain from Europe again this season, which is to be regretted on va-

rious considerations; one of which is, the effect it has on foreign exchanges, by creating a debt against us. The quantity of wheat imported into the United States, from 1st October, 1836, to 1st July, 1837, exceeded 3.500.000 bushels, according to official documents.

Cotton has not varied much in price for some weeks past. The crop of the U. States, brought to market during the year ending 1st inst., is 1.423.000 bales. The export during the same period to 1.167.425. The quantity manufactured in the U. States was 222.540 bales. A larger quantity than usual remains in the interior, which will go to swell the receipts of the ensuing year. The price of the old crop closed at 7 a 9½ cents, and that of the new opened at 10½, in Petersburg. The stocks in England are larger than for several years previous, but the price being low may increase the consumption.

X.

October 24, 1837.

SEASON AND CROPS.

For nearly or quite two months, there has been no rain sufficient to moisten the dried earth, or to cause any other than very slight and very transient benefit. After some early cold weather, and frost, which injured tobacco on low grounds, (where frost is always soonest felt,) the general temperature has been as unusually warm, as the weather has been unusually dry. Even on this day, (Oct. 24th) and the preceding, the heat of noon is like that of summer, and quite oppressive to the feelings. This drought has been a very serious obstacle to fallowing for wheat, unless where done very early; but on early and good fallowing, the absence of rain has greatly facilitated the sowing of wheat—and, unluckily has the process been forwarded, unless the extreme dryness of the earth will prevent the sprouting of the seed, until steady cold weather shall have set in. If the present warm weather continues until the wheat is generally up, legions of the Hessian fly will still be alive and active, and their worst ravages may again be feared and expected on the crop.

The corn crop through eastern Virginia, to near the mountains, is very irregular, on account of the very partial effect of rains, but generally will be worse than we supposed two months ago, and will probably fall below an average product. Tobacco in exposed situations, has already been damaged by frost, and probably much of the crop was cut prematurely, to guard against that disaster.

Grain and grass crops have seldom sold better than through the past year, and high prices may be expected for the year to come; and this, added to other circumstances of a more certainly durable continuance, make the present time especially profitable to the cultivators of grain, grass, and stock farms, and inviting to the investment of capital in land, and its improvement and cultivation.

From the Farmer's Cabinet.

PRESERVING PUMPKINS.

A correspondent at Union Bridge, Maryland, under date of May 9th. says—"in looking over the Farmers' Cabinet to-day, I find a request from one of your subscribers, for information as to the best method of preserving pumpkins through the winter. I answer that the way to preserve them one or more years, is, to pull them before the frost comes on, and keep them in a warm dry room. This is my method, and I have now several large ones in my house, in a fine state of preservation; and my neighbor, Mr. Davis Lightner, one of your subscribers, has them two years old at this time, weighing 43 lbs. each. They are very fine.

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